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EDITORIAL NOTES—GAS, &c.

Policy and Changing Circumstance.

ANNIVERSARIES have a way of stirring up more or less pleasant recollections. A fact of historical interest with which the Governor of the Gaslight and Coke Company (Mr. Corbet Woodall) commenced his address at the meeting last Friday may have caused some of the older proprietors to cast their minds back, and to pass through, in lightning review, periods when prosperity was not for the Company at high-water mark as reckoned in the industry. But the thoughts of any who made such retrospect were again hurried back to the present by the Governor's voice relating the causes that have contributed to the production in these days of a condition of prosperity never before attained by the Company. The historical fact with which he opened his address is that the Company are within a few months now of completing a century as a statutory concern. The application for an Act of Incorporation that was successfully made by the pioneers of distributed gas supply was lodged in the year 1810; and the Company were at work under the Act before the Royal Charter of Incorporation was granted in April, 1812. The Company have had a great and prominent part in the history of the gas industry generally; but if we take only into account the record of the undertaking in its commercial relations with London, then it can be said that the closing years of its century of statutory life have seen an unprecedented development of its affairs and of its services to the consumers. It is a case in which age has, by the application of administrative acuity, revealed an enormous amount of latent vitality, and the vitality has been energetically put to use to the advantage of a considerable section of the people of London, of the proprietors and workers of the Company, and of the undertaking itself. As a matter of fact, there has, in the last few years of the century's work, been created practically, or at all events largely, a new business for the Company, and a business of such a varied order that the long years which preceded, and which form the foundation of the present, seem years that are best forgotten for their inefficiency and crudity. Yet in the part of those years within our own compass we used to talk, from the then point of view, of the stability and prosperity of the gas industry; but the causes that then justified the statement appear in paltry light compared with the causes that justify to day the similar expressions. The point of view has changed, and (what is more) is still changing, and opening up fresh prospects to the eye.

The beneficial changes, however, that have occurred, and are still occurring, cannot be expected to have in all directions a perpetual full flow; and proprietors must anticipate this. The same changes, too, carry new responsibilities and new obligations; and these, too, proprietors must realize. Let us instance just one or two, as found in the Governor's address on this occasion. He called attention to the fact that the cost of meter and stove repairs continues to grow with the number of the consumers. But it is, he added, a matter for regret that there is, in relation to the past half year, a reduction of £10,000 in the cost of fittings, as it indicates a falling off in the rate of increase in the number of prepayment consumers connected. In the half year to June, 1910, the number was greater by 6000. "While it "would be foolish to generalize from the experience of "one half year, yet this fall does remind us that there is "a limit to the number of possible prepayment consumers "in our district, immense though it be. It also justifies the "policy adopted by the Directors, of acquiring the under-"takings of neighbouring small companies, and so obtaining "fresh fields for the enterprise of the Company." This emphasizes the fact that the change introduced by the prepayment meter into the business and circumstances of the gas industry cannot always be expected to be maintained at the higher recorded points in producing new business; but the diversity of the gas business, and the new openings that ever and again disclose themselves, to a very large extent neutralize any decline in the rate of expansion in any one direction. This, however, is a matter for the proprietors to realize—that productive change cannot always be expected to be sustained at the recorded maximum yield, and that with changes policy must comply.

A point may be instanced where change necessitates the application of a policy different from that which formerly obtained. With all the prosperity of the gas industry, there is greater need to-day for a good accumulation of funds in hand. There are changes that have come over the scene which make certain conditions that play an important part in the prosperity of the gas industry more sensitive than formerly; and if the conditions are adversely influenced, the position of a concern might be seriously affected if it—more particularly such a huge concern as the Gaslight and Coke Company—had not a good financial backbone. Some of the proprietors of the Company have thought that to carry forward a sum of £699,350, with prosperity at full tide, is unnecessary, and that a portion of it might be distributed as dividend. The Directors could not so dispose of it if they would, without exercising the condition precedent of making a reduction in the price of gas. It was only a few weeks since that the Governor and others satisfied a Committee of Parliament that, in view of the extensive operations of the Company, it would be most unfair to limit the carry-forward, as is now becoming the practice, to a sum equal to a year's dividends. A very substantial sum in hand (in one place or another) is more necessary than ever, owing to the ramifications and character of the business, as well as to certain readily fluctuating conditions that have their bearing upon the degree of success. Without such reserves, there is the ever-present risk of having to alter the relations of the Company and the consumers, and of putting a spoke in the wheel of progress, by raising the price of gas. The conditions of labour in the coal market are now such that never for any long period can the gas industry rely on constancy in the price of coal. It so happens that, in respect of the net cost of coal, gas undertakings—the Gaslight Company among them—have recently been in an abnormal position. Contracts for coal have been entered into by the Company at somewhat lower prices than ruled last year; and at the same time the markets for the secondary products are maintaining an unusually good tone, especially having regard to the fact that this applies more or less to all residual products. What reliance, however, is there that these conditions will be maintained? Coal contracts are now running at the lower price; and everything looks favourable in regard to residuals. Nevertheless, coal may rise in price; residuals may descend. Who can tell? Therefore the need for giving a good breadth to a gas undertaking's financial policy in these days. At the same time, the Governor expressed the confidence of the Board that further reductions in the price of gas will be taking place in due course; and then the proprietors will further benefit through their dividends, with an appreciation of the market values of their stock.

All this, however, goes to show how, according to the circumstances of a concern, administrative policy must undergo revision, in order to meet changes in business and condition. Old-fashioned habiliments will not always serve adequately; and had the Board of the Gaslight Company, under their new leader, not realized this a few years ago, the concern would probably have been still lumbering along with a smaller business, a heavier price to the consumers, a lower dividend, and a market price for the ordinary stock at below par. Those proprietors who, having already tasted improved dividends, are asking for more, should recognize that the existing Board require no urging to do the right thing; and the past few years claim for them the knowledge as to what is the correct course to take. The speech of the Governor shows how prosperity has been accruing under the new policy. Less capital is employed per ton of coal carbonized, less money is required per ton for interest and dividend, yet a higher dividend is paid, the consumers have had within easy recollection four penny reductions; the 4d.

representing £400,000 a year on present consumption. Further, more gas is made per ton of coal carbonized; the works have been very largely modernized; and economies in working have been achieved that have made an extraordinary impression on results. The consumers are responding to the benefits they have received by an increased use of the cheaper gas. But the outstanding illustrative feature of the Governor's address is that policy, like most other things, must be modernized as occasion demands, in order that it and changed technical and commercial conditions may not be antagonistic.

Gas Workers and National Insurance.

During the past week or so, the agitation among London gas workers for obtaining exemption from the National Insurance Bill in respect of sickness, where it can be shown that "the terms of the employment are such as to secure "provision in respect of sickness and disablement on the "whole not less favourable than the corresponding benefits "conferred by the Act," has been prosecuted with vigour. What offends is, as we have before pointed out, that under the present sick funds and methods of administration, in connection with their employment, the monetary benefits are greater and the expenses are less than they would be under the terms of the proposed Act. This was recently illustrated by Mr. Charles Carpenter (*ante*, pp. 91, 120), as well as by Mr. Charles Hunt in a tabulated statement circulated at Friday's meeting of the South Suburban Gas Company. The matter, however, is essentially one for the workers; but the information to hand shows that the Boards of the Gaslight and Coke Company, the South Metropolitan Gas Company, and the South Suburban Gas Company are backing up (as may be the boards of other companies) the views of their men in this regard. And it is right they should do so; for in times when the tenets of Socialism are spreading with such rapidity among some sections of the country's workers, it is refreshing to see several thousands of gas workers moving for the defence of their existing conditions as against new State-designed conditions. As Mr. Corbet Woodall said in his speech to the proprietors of the Gaslight and Coke Company last Friday, this shows the employees' "appreciation of the "fact that their interests, both in regard to provident funds "and in other directions, are carefully safeguarded by the "Board." The London gas workers have a long experience of the safeguarding of their interests in this particular—in the case of the South Suburban Company, Mr. Hunt was saying on Friday, extending to 31 years, and the period may be longer in respect of the larger companies.

This is a very flattering sign. But what is being actively done? The employees of many concerns may be at work, trying to obtain "exception" under the condition laid down for local or other public authorities, as quoted at the commencement of this article; but special measures are being taken in certain cases. The Governor of the Gaslight and Coke Company, on behalf of their men, has addressed a letter to the Chancellor of the Exchequer, asking whether it is possible that they may be left outside the purview of the Act—the Company guaranteeing the solvency of the funds. The South Metropolitan Company's men have been taking very active steps. Members of a Committee of the employees have sought, in the lobbies of St. Stephen's and elsewhere, interviews with Ministers and Members of Parliament so as to enlist their sympathy. In all cases they have been given a hearing, and, in the main, the members interviewed have agreed that such cases as theirs deserve exceptional treatment. The South Suburban Company's men have been doing the same thing. As a result of the representations of the workers of the various Companies, Sir Henry Kimber, Sir Fortescue Flannery (who is a Director of the South Suburban Gas Company), and Mr. R. J. N. Neville (who is a Director of the Brentford Gas Company) are giving notice of amendments, with the view of endeavouring to realize the desire of the men, who naturally prefer their present conditions to the State proposals. But the South Metropolitan men have gone farther than this. They have sought and obtained an interview with one of the officials at the Treasury, acting as the representative of the Chancellor; and the men, headed by the Chairman of the Company (Mr. Carpenter), had this interview last Wednesday. It is hoped Mr. Lloyd George will, as a result, see the reasonableness of the case that his representative had put before him, and act accordingly.

Instead of continuing to operate independently in this matter, why should not the workers of the various Gas Companies unite in some way? They could make an impressive showing standing alone as the workers of a single industry, although there are other big interests in precisely the same boat. We see, for example, that at the meeting of shareholders of the London, Brighton, and South Coast Railway the other day, the Chairman said he feared that the insurance scheme, if it passes in its present form, would add a heavy burden to the expenses of the Company; while to the staff, or a large proportion of the staff, it was doubtful whether the benefits would prove as advantageous as those they now enjoy. This helps to show how widespread is the existence of funds that are superior in their effects to the Chancellor's scheme. There is no objection whatever to making provision against sickness compulsory; but there is an objection to worsening the position of a whole army of employees in order to place in a better position those workers who are not in the enjoyment of the same privileges. Surely the latter can be legislated for in some way without reducing the former to an inferior position. This is not by any means a party matter; it is a question of justice. Therefore we echo the words to which Mr. Hunt gave utterance on Friday, to the effect that, if any gas proprietors can assist the employees in this matter, by bringing pressure to bear in any quarter in which they may have an interest, they will be doing a service to them.

Calorific Power, Unit of Light, and Other Matters.

The sketch of the proceedings at the Conference of the International Photometrical Commission at Zurich that appeared in our columns last week, indicates that there were certain matters of current practical importance under the consideration of the delegates, and one of them especially so at the present time to this country. This had reference to the looming question of the suppression of the illuminating power standard and the substitution of a calorific power one. Any expression of opinion that is unanimously concurred in by the delegates forming a Commission international in character, as is this one, must carry an influential amount of weight. This being so, it must have given pleasure to the two representatives of British gas interests who are accredited by the Institution of Gas Engineers—Dr. H. G. Colman and Mr. W. J. A. Butterfield—to have heard the deliberate and unanimous opinion of the Commission that the test of the illuminating power of luminous flames has lost all importance under modern conditions, and that for the evaluation of gas to-day a test for calorific power should be substituted for that of illuminating power. This distinctly shows that the International Commission disapproves *in toto* of any dual test for gas. Everyone who has made a study of latter-day developments of the gas business must now be convinced of the absurdity of the retention of a test representing a standard of quality valueless in relation to the uses of gas. The Commission did not go the length of suggesting what, quantitatively, the calorific standard should be. It is a matter beyond their province, and an impossible thing for them to essay. Local conditions, methods of carbonization, the characteristics of the coal used, and other matters must all be factors for consideration in the determination of a standard; and therefore it must be left to decision in each country, and in every individual case in each country—the same as the illuminating power standard has hitherto been determined. However, the resolution that was passed was the matter of importance; and the expression of opinion will be welcomed as highly satisfactory and useful.

Touching this question, Dr. Colman invited some further expression of opinion from the Commission as to whether calorific standards should be "gross" or "net." In this country, though the only example of a statutory calorific power standard is represented by the "net" value—that is, the Gaslight and Coke Company's standard—expert opinion, we think it may be confidently said, inclines to the "gross" value. The time will soon be expiring when the Gaslight Company will have the right to claim the consideration of the revision of the terms under which their gas is at present tested; and it is to be hoped that attention will be given to this particular point among others. Bearing upon this, there is a significant statement in the Notification of the Metropolitan Gas Referees, which indicates that, in that influential quarter, the "net" value is not regarded as of importance. The passages to which we refer are these:

> The maximum calorific power which gas can thus exert is determined directly by the calorimeter. This is a true measure of the total heating power, and is termed the gross calorific power of the gas.

But in many cases in which gas is used as a heating agent, the steam which is formed escapes into the air uncondensed; and thus the heat due to the condensation of the steam and the cooling of the water so formed is not utilized. The amount of heat thus lost can be estimated; and if it is subtracted from the total heat yielded by the combustion of gas in the calorimeter, another value is obtained which is termed the net calorific power of the gas. Since, however, when steam escapes uncondensed, the uncondensable products of combustion also pass away at a high temperature, and since the loss of heat thus arising is commonly the greater of the two, *the customary partial correction from gross to net has not much significance.* [The italics are ours.]

From which it is plain the "net" value does not find sympathizers in the Metropolitan Gas Referees.

However, to return to the proceedings on this point at the sitting of the Photometric Commission. It may be said that all countries, excepting France, are favourable to the "gross" value being taken as the standard. But, as the representatives of France at the conference were of the contrary view, Dr. Colman (seeing that on this occasion a unanimous vote was not possible) withdrew his suggestion. It is only a question of detail. On the fundamental point as to calorific value being the rational standard and not illuminating power, it is something gained to have the unanimous judgment of the Commission. But this particular "detail" will most probably be brought up again. It is a legitimate matter for the Commission to deal with; and our friends in France may in the meantime be asked to give it further consideration, and to take a very broad survey. If they do so, they will find, as we have said, much expert opinion in this country in favour of the "gross" value being taken. Mr. Butterfield—one of the British delegates—we remember long since, spoke in its favour. Germany has oftentimes given evidence of the preference that exists there for the gross value. America, in its calorific standards, has adopted the "gross;" and so we go on. France at the moment appears to occupy in this respect a solitary position. We hope this state will be changed, on reconsideration, by a transference of opinion from the "net" to the "gross," so as to offer a solid international agreement on the point.

The subject of an international unit of light was also discussed; but we are not yet to be allowed to give the candle the nominal distinction of being "international." On behalf of the British gas industry, Dr. Colman and Mr. Butterfield pressed for the adoption of the candle as the international unit. But Germany and Austria decline to adopt it; and so the term "international" has to fall. England, France, and America are favourable to the candle as the standard unit; and therefore the Commission have made a real advance in assisting in bringing three nations which formerly had different units to adopt a common one. This, in effect, means that four pre-existing units have been reduced to two—the candle and the Hefner unit, between which there is the simple relation of 0·9 candle being equivalent to 1 Hefner unit. It would, of course, have been a distinct advantage to have obtained an international unit of light; but the impossibility at the moment cannot be helped. The reduction achieved in the number of units, however, brings us nearer than before to a united front in this matter. As to the prospects, we are not sure that the German electric lamp makers would not prefer to have the candle as the unit, inasmuch as, the ratings on their lamps being at present in Hefner units, a lamp marked (say) 16 Hefner units bears a poor contrast in illuminating power to one rated and marked 16 standard candles. Similarity of rating, with a difference in illuminating result, has the tendency to bring their productions into disrepute. Connected with this subject, the inapplicability, under the circumstances, of the term "international" candle, led to discussion as to the application of the descriptive terms "normal," "standard," or "*décimale*." But no agreement was arrived at; and in this country we shall be quite content to continue using the term "standard candle."

A general point to which consideration was also given at the Conference had reference to the raising of the number of accredited representatives from each country, in order to give greater assurance of the attendance of delegates from time to time who are cognizant of the work of the Commission. It was considered desirable; but the voting power of each country is to be represented by one. Another interesting point was the application on behalf of German electrical institutions for admission to the Commission; and on this point it was resolved to welcome them when matters of mutual interest are under consideration.

In another part of the "JOURNAL" to-day, extended notice is made of other portions of the proceedings not dealt with in the general reference of last week. From the account presented, from the foregoing comments and those made last week, together with the important paper by Messrs. Butterfield, Haldane, and Trotter, it may be said that the proceedings at the Conference must be voted as being of considerable technical value.

Competition of the Diesel Oil-Engine.

THERE are some people who think the large amount of attention that is being devoted to the Diesel oil-engine in technical circles is a tribute as much to brilliant commercial energy as to any distinctive merits that this type of oil-engine possesses. Whether this be so or not, the fact remains that the engine has obtained considerable investigation at the hands of men of good technical position; and it has already received a very fair amount of adoption. Moreover, it has induced research into the question of its fuel supply on the part of our friends at the Carlsruhe experimental works of the German Gas Association, as mentioned a fortnight since. It is in the direction of this fuel supply that the gas industry has a limited interest in the development of the engine. The industry would prefer to be left without further competition with town gas for power purposes. But such preference will not stay developments of the kind; and therefore the situation must be accepted, and the best use possible be made of the fact that gas oil tars and the tars from vertical retort working that contain little naphthalene and free carbon form one of the sources of fuel for these engines, if the price permits of their use in comparison with the several other available fuels.

But we do not entertain any opinion that the Diesel engine will form a serious competitor with town gas, where this is cheap, for power purposes. It must always suffer the disadvantage in the eyes of the manufacturer, in comparison with town gas, that the fuel has to be purchased, then conveyed to his works or factory, and there stored, besides which there is the attendant labour involved in feeding and so forth. In this respect, it is very much like suction or pressure gas plant; and it is with such plant that it will be the strongest competitor. But if business for suitable tar can be developed with the users of such engines, as business is being developed in coke supply for suction-gas plants, as between these two methods of power production the gas industry must stand upon neutral ground—regarding at the same time both as competitors with town gas. There is another respect in which the Diesel engine bears a strong resemblance to the suction or pressure gas plants, and to its disadvantage in comparison with town gas, and that is it appears to require a fair amount of attention in order to keep its working parts clean. The very nature of the fuel used suggests that this must be so; and there is confirmation in a paper which Mr. F. Schubeler read before the Institution of Mechanical Engineers, at their recent meeting in Zurich, although he stated, on information received, that engines had worked for six or eight weeks without interruption, even in cement factories, and in mills. We have nothing at hand authorizing any contradiction of this. But just as one swallow does not make a summer, so isolated examples may not represent the rule. But given the ordinary rough working conditions under which all engines are operated in many places, we can quite conceive that the Diesel engine, having regard to the characteristics of the fuel used, may exact more cleaning than town-gas driven engines through carboning up, trouble with dirty valves, and so forth. The paper of Mr. Schubeler (which we print in this issue) is of interest in the information it contains as to the disadvantages and advantages of the engine as the author sees them; and it also points to the lines of future development. It is of importance that gas engineers should be kept advised as to developments which produce new competition, or which offer a new line for business.

However, there is something more than mere fuel economy for the manufacturer to consider in making choice of the means of power that he requires. But there must be protest against any unfair comparisons for his guidance. In the paper before us appears this statement: "It has also "been ascertained that two-cycle gas-engines show an in- "creased fuel consumption at partial loads; whereas the "two-stroke cycle Diesel engine has, with smaller load, "consumptions which only differ slightly from those obtained "by normal load." The layman on reading this sentence might possibly imagine that the difference was considerable; whereas (whatever the consumption difference may be with the Diesel engine as between normal and partial load) the fact is that the difference proportionately between

normal and partial load is only small in the case of the modern gas-engine. However, the efficiency stated for the Diesel engine is good; and there is still room for development in this regard. The fuel costs per kilowatt hour as quoted by the author towards the end of the paper are also low. But as we have submitted, fuel costs do not comprehend the whole of the expenses in running this type of engine. On the other hand, the latitude given to users of the engine by the variety of the sources of fuel supply is an undoubted advantage.

From all considerations, it seems clear that the competition of the Diesel engine will be chiefly with power competitors employing solid fuel. Shipping is a large user of solid fuel for propulsion purposes; and interest is awakened in the engine under notice becoming the possible channel of one of the big ship-engineering developments of our times. Lord Furness called attention to the matter a few days since at a meeting of Furness, Withy, and Co., Limited, who have given the first order for a cargo vessel to be fitted with the new type of engines. Lord Furness is known as one of the business captains of the North; and bringing his keen and trained penetrative powers to bear upon the capabilities of the engine, he is sufficiently persuaded as to the genuineness of the foundation for the claims (though he will not certify the accuracy of the latter until he has put them to thorough test) to entertain a strong belief that there lies in this invention the prospective means of revolutionizing the methods of propulsion in shipping. Here are the reasons for his belief in the economic applicability of the system for the propulsion of ships. The distribution of oil is at least as wide as that of coal. Its manipulation is easier; and the dangers are not in any degree greater. The weight of fuel is but a fifth part of that required for a first-class steam plant of equal horse power; and ton for ton less stowage space is required. Oil, too, can be handled through pipes with a minimum of labour. There will also be a saving in space of boilers and condensers. These are obvious advantages; the mechanical ones are to be yet tried for this particular work. It is befitting the position of a firm of the standing of the one presided over by Lord Furness that such experiments should be made by them, in the cause of the world's progress.

A High Sulphate Make at Lower Sydenham.

The South Suburban Gas Company have had an excellent half year; and the Chairman (Mr. Charles Hunt) had therefore a good tale to tell the proprietors at their meeting in the new Livesey Memorial Hall [described elsewhere] at Lower Sydenham last Friday. It must be the Company's best year in financial result on record. The consumption of gas, compared with the first half of 1910, increased by 5·01 per cent., and 3·65 per cent. of this was increase outside the Festival of Empire Exhibition at the Crystal Palace. The work that the Company have done at the Palace has, by the way, created a great amount of interest in technical circles, and among public lighting authorities. For what has been done there, and in connection with the Company's business generally, the Chairman awarded praise, without stint, to Mr. S. Y. Shoubridge, the Engineer and Manager, and his staff. The co-partners of all kinds are to share in the fruits of prosperity. The price of gas goes down to 2s. 4d., the proprietors will soon be entitled to a dividend at the rate of £5 16s. 8d., per cent., and the employee co-partners will receive another ½ per cent. bonus (making 7 per cent.) upon their wages. All residuals stood well by the Company during the half year; and commendation was paid to the Sulphate of Ammonia Committee for the work they are doing in connection with this secondary product. In dealing with the matter, a very striking sentence fell from Mr. Hunt. It was this: "I am sure you will agree that Mr. Shoubridge and his assistants deserve well of this Company when I tell you that the increase during the last two years in the quantity of ammonia recovered per ton of coal carbonized, represents an annual value to the Company, at present prices, of about £2000." Perhaps, if he had not been modest, the Chairman might have gone a little farther than this; but the statement is sufficiently remarkable. If we look into the working results, it is seen that in the past half year 782 tons of sulphate were made; and we calculate that this averages 27·3 lbs. per ton of coal carbonized—a high average indeed. Why is it that the make at Lower Sydenham is from 5 to 8 lbs. per ton of coal in excess of certain other concerns whose accounts have been examined as the result of Mr. Hunt's remark?

Good and Bad Experiences at Brentford.

The Brentford Gas Company have been proving that expenditure on reconstruction is an excellent investment, when parts of the works have run down to a point that does not conform with present-day efficiency. The work that Mr. Alex. A. Johnston, the Engineer and General Manager, took in hand for the Company a few years since is paying for itself and to spare. While the changes were proceeding, the Company were not in a position to do much for the consumers; but energy outside the works as well as inside meanwhile so developed business that twelve months ago the price was reduced 2d., and there is another 2d. coming off at Michaelmas, when the consumers will be receiving gas at 2s. 5d. They are now benefiting considerably from the work that was taken in hand. There was another matter to which the Chairman (Mr. Ulick J. Burke) called attention at the proprietors' meeting on Wednesday last; and it is one upon which the Directors and the proprietors feel very sore. It is really a monstrous thing that a statutory company such as this should be put to a double, and each time heavy, expense in defending the same statutory rights in Parliament. In a recent session, the Greater London Railway scheme was promoted; and the authors of the project, apparently indifferent to any interests but their own, proposed to cut right through the Southall works of the Company, which have been developed on lines to serve the present and future requirements of the supply area. They were at the time defeated, but at considerable expense to the Company. Again they came in the present session, seeking similar power; and again the Company defeated them, but once more at considerable expense. It is a strange condition of affairs that enables this sort of thing to proceed, and repeatedly involve a statutory company of this kind in expense of such a character in defending the powers that the Legislature has granted them, and which expense is really so much loss to the consumers. If there is any consolation to be derived from the fact, the proprietors of the Brentford Gas Company will have learned with satisfaction of the complete rejection of the scheme last Thursday by the House of Lords Committee who had been considering it.

An International Miners' Congress.

A large number of resolutions were passed by the International Coal Miners' Congress during their sittings in London recently; and presumably the different delegates will have returned home satisfied with what has been accomplished in this way. The establishment of a minimum wage was favoured; and it was agreed that the mineral wealth of the land belongs to the nation, and should therefore be worked in the interests of the community. Another motion passed, which was submitted by Great Britain, called for legislation to increase the safety of mines; it being pointed out that, in spite of the advancement of science, the number of fatal accidents in coal mines was on the increase. Mr. A. Stanley, M.P., remarked that a very important measure dealing with this question had been introduced by the Home Secretary; and before this became law the miners' representatives would insist on the supreme necessity of certain safeguards. Among these was an adequate inspection of mines, an improvement upon the means of ingress and egress at present in force, and a better system of mine ventilation. Another danger had resulted from the introduction of electricity into the mines. In his assertion that at least one of the most appalling of recent coal-mine accidents was due to electricity, he was supported by the best opinion of the country. On the suggestion of the German delegates, it was agreed that "the length of the shift of all the workmen employed in the mining industry on the surface or underground should be reduced by law to eight hours from bank to bank. In very hot and wet places, the length of the shift should be six hours at the most." Several resolutions affirming the principle of miners' pensions for old age and invalidity were passed, as was one demanding improved housing accommodation and the passing of legislation to prevent the eviction of "workers" from their houses during an industrial dispute. More serious matters than some of those already mentioned were considered towards the close of the congress. One resolution which was referred to the International Committee expressed the opinion "that the regulation of production is desirable, and that, in order to achieve it, it is expedient to employ every means at the command of the Miners' Unions, and especially the national strike in case of necessity. The arguments advanced in favour of this proposition were (1) that there has in recent years been an

enormous increase in production of coal, and when the output is greater than the consumption, and stocks accumulate, wages are reduced and strikes encouraged, because they tend to reduce output; and (2) that when a strike occurs in one country, the owners in the other countries increase their output in order to send coal to the strike area. In the course of the discussion, one of the South Wales delegates remarked that Welsh coal used to find a good market in the North of France; but it had been driven out of that country by the Westphalian Syndicate, at a price at which they could not get the coal to the pit's mouth in South Wales.

Some Mining Statistics.

In connection with some of the business transacted by the congress, notice may be taken of the subsequent issue of Part I. of the Annual General Report on Mines and Quarries for the year ending Dec. 31, 1910 (which is signed by Mr. R. A. S. Redmayne, the Chief Inspector of Mines). During the period referred to, the total number of persons employed in and about all the mines of the United Kingdom was 1,078,083, of whom 1,049,407 worked at the 3253 mines under the Coal Mines Act. This, compared with 1909, is an increase of 35,409 persons. Just over 80 per cent. of the total number were employed below ground. The total output of minerals at the mines under the Coal Mines Act was 278,609,949 tons, of which 264,417,588 tons were coal, 2,484,069 tons fire-clay, 7,979,750 tons ironstone, 3,130,280 tons oil-shale, and 598,262 tons sundry minerals. Adding 15,440 tons from open quarries, the total output of coal was 264,433,028 tons, which is an increase of 658,716 tons over the previous year. Scotland shows a marked increase of output (1,566,767 tons); it being pointed out in the report that the introduction of the statutory eight-hours working day would have little adverse effect on the producing power of Scotch collieries, as what was practically an eight-hour day had been universal in the East of Scotland for some years prior to the passing of the Act. A large increase in the output of the York and North Midland district (2,896,148 tons) is accounted for by the extension of the industry eastwards in Yorkshire, where new coal areas are being opened out. In South Wales, a substantial decrease (1,663,955 tons) is chiefly accounted for by the stoppages of work which took place at several large collieries owing to disagreements relating to wages questions. Then a large reduction of output in the Northern coalfield (amounting to 2,836,016 tons) is largely due to the stoppage of work at a number of collieries during the early months of the year, consequent on difficulties arising from the re-adjustment of shifts under the Eight Hours Act. The average output of minerals at mines under the Coal Mines Act was 328 tons per person employed underground, or a decrease of 12 tons on the previous year. At these mines there were during 1910 1242 separate fatal accidents, causing 1775 deaths, or 322 more deaths than in the preceding year. Compared with 1909, there was also an increase of 5736 in the number of persons injured in the mines. The death rate in 1910 of the underground and surface workers as a whole was 1·69 per 1000 persons employed, as against 1·43 in the preceding year. The total number of deaths from accidents at mines under the Coal Mines Regulation Acts, adds the report, is the highest yet recorded in any one year. The ratio of deaths per 1000 persons employed is, however, the proper criterion of comparison to adopt; and we have to go back to the year 1890 to find a higher death rate from all causes underground, when the figure was 2·09 per 1000, as against 1·91 last year.

Personal.

At the last meeting of the Southampton Town Council, the names of the three candidates selected by the Water Committee out of 77 applicants for the position of Water Engineer were submitted; and, in the result, Mr. E. C. Rodda, B.Sc., of the City Engineer's Office, Sheffield, obtained the appointment.

A pleasing incident followed the business proceedings at the half-yearly meeting of the Runcorn Gas Company last week, when the Chairman (Mr. Frederick Rigby) presented to Mr. J. R. Frith, the Engineer and Secretary, three beautiful fruit-dishes of silver gilt, bearing the following inscription: "Golden wedding, June 20, 1911. Presented to Mr. and Mrs. J. R. Frith, as a mark of esteem, by the Runcorn Gas Company.

The death occurred on Monday last week, at his residence in Lisburn, of Mr. John Stevenson, who was Chairman of the Lisburn Gas Company before the transfer of their undertaking to the Urban District Council. Deceased was upwards of eighty years of age.

ELECTRICITY SUPPLY MEMORANDA.

Business Getting—Sankey on Canvassing for Small Concerns—Future of Electricity Meters—Wonderful Heating Novelties—Bearing Electric Burdens at Newcastle-under-Lyme—Provisional Orders.

Apart from the work of the Electricity Publicity Committee, electricity undertakings throughout the country are, generally speaking, individually doing more in connection with canvassing and publicity, or at all events are considering the question of greater activity. But some of the administrators of these undertakings are said to have little ideas in the matter, which make it all the better for the gas undertakings. Of this, however, they may be sure, that whatever they do in this direction the managements of gas undertakings will keep their eyes upon them, and will not be very long in at any time going one better. The little notions as to what is desirable of some managements of electrical undertakings—not by any means of all—is considered by certain contemporaries to be a fit subject for badinage instead of merciful sympathy. The Hammersmith Borough Council last year were frightfully prodigal. They spent as much as £50 on publicity literature! But their ideas are expanding this year; and they have just voted £300 for business development, which is to include the annual salary of the canvasser. Their "reckless" enterprise has brought down upon their highly developed commercial intelligences an amount of ridicule from certain folk who think that they occupy a place at the very base of the fount of wisdom. Surely the Hammersmith Borough Council know their own needs best; and they are of opinion that the sum in question will be sufficient this year in counteracting the "active methods pursued by the gas companies." The electricity undertakings are finding difficulties crowding in upon them. The popularity of high-pressure gas lighting, the growing popularity of the gas-fire and of water heating by gas—the recognition of the labour-saving ability of gas throughout the house on economical terms, from installation and maintenance to running expenses—are all obstacles to business-getting by the electricity supplier. It is to propagate knowledge of these things that the general publicity work and the private canvassing methods of gas undertakings are being pursued with vigour. Knowledge and experience of the utilities of gas, and advances in methods among householders and others, are the best barriers to effective results from the efforts of our electrical competitors, who are as much at liberty as gas undertakings to prosecute systems of business development, providing they refrain from the use of malicious slander with the view of damaging legal rights.

The smallest of gas and electricity undertakings can do something in the way of canvassing, and increase the load on the concern. Mr. W. Sankey, the Borough Electrical Engineer of Whitehaven, has in "Electrical Industries" been singing the praises of canvassing work for modest sized concerns. The £ *s. d.* side of the question is an important one; and small concerns cannot afford to keep a canvasser solely for the work covered by the title. What does Mr. Sankey do? He obtains the services of an intelligent man, who can canvass, fix and read meters, and (this is important) change the meters, and, in fact, do any work on the consumers' premises other than the laying of the service. That canvasser of multi-qualification creates his own work. Mr. Sankey has been going in for main extensions; and he employed a temporary canvasser, at 30s. a week, for nine-and-a-half weeks. His wages, and the requisite outlay for printing and stationery, came to £19 11s. 7d. Direct results do not appear to have been great as the result of this expenditure; but it was looked upon as the necessary cost of tilling the ground. Then the canvasser-craftsman was engaged; and from then to March 31 last the amount fairly chargeable as the cost of obtaining new consumers—30 on the new network, or 33 on the whole system—beyond the average of former connections on the old system for the same period, is £33 16s. 9d. This includes all the canvasser's time charged to consumers' premises account £22 9s. 2d., and printing, stationery, bill-posting, &c., £11 7s. 7d.—together £33 16s. 9d. Adding this sum to the £19 11s. 7d. previously spent on the work of the temporary canvasser, it will be seen that it makes a total of £53 8s. 4d. During the period covered, the revenue from the 33 consumers amounted to £54 17s. 3d.; so that there was only a balance of £1 8s. 11d. to pay for electricity and all the other expenses incurred in the supply. If the matter is looked at this way, and future business with the 33 consumers is of normal character (it is expected to get an average revenue of between £3 and £4 a year from them), and if the canvasser-craftsman goes on bringing in new business at the same rate (which we doubt now that the cream has been obtained)—well, Mr. Sankey proves the value of this sort of man to the small undertaking.

Electricity meters—to be, or not to be, is the oft-debated question. Managers of electric undertakings are often frothily talking of doing without them in the case of small supplies. But as experience generally expands, it all ends in falling back into the old rut; and it is a case of "with all your faults, I [perforce] love you still." Mr. A. T. Bullen has been writing in one of our contemporaries as to the future of the electric meter. This is a big subject; and to deal with it properly, it is necessary to be prophetic. He neatly sketches the character of the meter in his opening lines; and it is virtueless. "To an electrical supply company," he says, "the capital expenditure on meters, the relatively high allowance necessary for depreciation on them, the losses incurred by their use, and the cost of maintenance, are very serious

items from a financial point of view." He forgot to mention their want of reliability, which sometimes means a serious piece of business from either the electricity supplier's or the consumer's point of view. Treating of the proposals to do without the services of meters by charging so much per light or per week, Mr. Bullen refers to restraint in the use of electricity where there is no check as being a lessening quality as time courses; and, like ourselves, he, we gather, harbours the belief that landlords are not going to be such fools as to take upon themselves the burden of being collectors for any electricity undertaking, and of being responsible for the money due by their tenants. Among the difficulties of charging without a meter, he points to the one that all classes in London (he might have added, and in large provincial cities and towns) keep much later hours than the people in some of the smaller provincial towns; and where a fixed sum might result in profit in a relatively small town, it is probable that considerable loss would be incurred at the same price in London. Again the cost of generating electricity would not in all places permit of a meterless supply to any dwelling at 6d. a week. For instance, it could not be done at Bournemouth. However, competition is bringing down the price of meters; and, after weighing all considerations, Mr. Bullen comes to the conclusion that "manufacturing firms and those workmen employed in the meter industry, need have no fear for the future, for the electric meter, like its gas colleague, is here to stay." Electric meter makers will bless Mr. Bullen for his encouraging words. The gas industry is pleased to place Mr. Bullen in an altogether different category from those electricals who display their imbecility by stating their belief that the electricity industry is going to crush the gas industry out of existence. It would be no use the gas-meter staying (as Mr. Bullen says it will stay) if there were no gas-supply undertakings in the land.

We come across some queer devices at times in our walks along electrical paths. A new system of electric heating is introduced to us. It is called the "Tubead"—an awful looking title compounded of "tube" and "bead"—and the thing itself is simply a combination of a length of seamless steel tube (say 7 ft. 6 in.), through which is run a high-resistance wire element on which glass beads are threaded. The tube is closed at one end, and at the other is provided with a connecting-box—the arrangement being carried by supports, arranged for attaching to the floor or wall. The standard consumption of electricity is a unit per hour. The elements are run at red heat, and the tube quickly warms up, heating the room by convection. People do not like convected heat so much as radiant heat for general room warming. It is also stated that precautions must be observed in fixing the tubes on account of the high working temperature; and a good place is said to be near the skirting or on the wall. For our own part, we should prefer not to run tubes at high temperatures too near the skirting boards. For cooking utensils, the wire element with its bead insulating supports is wound spirally between expanded metal discs; the base of the whole being of stoneware. These elements are usually made for a consumption of 700 to 1000 watts, and ordinary kettles or saucepans can be employed with them. It is a wonderful system. Working at such high temperatures, it is stated that the beads do not crack though water or other liquid be spilt upon them. The efficiency is stated to be high—as high as 68 per cent. for a hot-plate system employing ordinary utensils. Well, well!

The scriptural advice that we should benevolently bear one another's burdens is good up to a point; but it ought to be cut short at the entrance to the business world. In last week's issue, we had a little account of some proceedings in the Newcastle-under-Lyme Council, in which certain very kind things were said of the Engineer and General Manager of the Gas Department (Mr. Frank L. Wimhurst) and of the Engineer of the Electricity Department. What, however, interests us most at the moment are the remarks that were made at the meeting by two worthy members, which amounted to an acknowledgment that the Corporation have been coolly robbing the gas consumers to pay for the deficiencies in revenue drawn from the electricity consumers. We have heard of this sort of thing being done elsewhere; but the fact that a few others besides the Newcastle (Staffs.) Corporation have been guilty of this barefaced plundering of supporters of one undertaking to make up the deficits of another undertaking does not in any way justify the proceeding. We agree with Mr. Mayer that the electricity undertaking ought to be compelled—honesty demands it—to repay its debt to the gas undertaking. But it is seen from the local paper and the electricity journals that it is considered by the electrical partisans that the gas-works have had a *quid pro quo* through having the electricity undertaking as a power customer. It is rather an expensive proceeding to have to pay £700 odd for the custom of an electricity concern for gas at a favoured price for power. It takes all the gilt off the transaction. We happen to know something of Newcastle-under-Lyme, and the association of the Gas and Electricity Departments; and so there is knowledge that the former has been very generous to the latter. Gas is supplied to the electricity station for generating purposes at 1s. 9d. per 1000 cubic feet; whereas the ordinary price of gas for general purposes is 2s. 8d., and for power 2s. 4d. We remember, too, that the electricity plant has found habitation on the gas-works lands, and we have never heard that the Electricity Department pays rent for the accommodation. The accountancy work of the Electricity Department used to be done by the clerks of the Gas Department. We suppose this holds good now. The chief officer of the Electricity Department at one time found a room and a seat in the Gas Department's building. It is all very well to follow the scriptural injunction in private life. But the Gas Department at Newcastle-under-Lyme does more than its share in this sort of thing. It has acted the part, in its relationship with electricity, of an indulgent parent to the prodigal younger son. The dignity of the Electricity Department, if it possesses any, surely suggests that complete restitution be made. The electricity concern is now, under the benevolent treatment received in the matter of lightening its expenses, making a little bit of profit—it having attained its full load. But there is a desire to spend £6000 on extensions; and if this is done, we suppose the undertaking will again become profitless until the extensions secure full custom. Do not the Corporation think it would be a good thing to go on making a bit of profit for a time with which to pay back the gas undertaking the financial assistance rendered, and then look into the question of extensions to see what can be done, without further committing the concern to the *infra dig.* position of having to rely upon the gas undertaking?

The report of the Board of Trade on their proceedings for the past year under the Electric Lighting Acts is anything but thrilling. The schemes dealt with in the Orders are for the most part merely extensions of existing concerns. Altogether there were 28 applications for Orders, of which eleven were by local authorities and seventeen by companies or persons. In the case of five of the Orders, the districts defined in the applications were more or less curtailed by the Board. Two of the applicants—the Bognor District Council and the Uxbridge and District Electric Supply Company—determined not to proceed with their applications. The Board would not, after considering all the circumstances of the case, grant a proposed extension by the Bermondsey Borough Council. It would have been vastly better for Bermondsey if some power had originally prevented them entering upon this electric supply speculation, and if, assuming the people of Bermondsey desired electricity, a private company had taken the supply in hand. There was an application from the New Electricity Company of Macclesfield. The Corporation refused their consent to the application; and the Board dispensed with the consent, so that the Order proceeds. From a table published with the report, it is seen that between 1883 and 1910, 1386 Orders were applied for, and 1088 were confirmed by Parliament. But 334 have been revoked, repealed, or have expired.

NOTES FROM WESTMINSTER.

PARLIAMENT is going to adjourn on the 18th inst.; but there is to be an autumn sitting. We are, however, at the tail-end of the work in Committee-rooms; and it may be taken that all Private Bill business will have been completed before the adjournment, and that the autumn sitting will be devoted completely to the large contentious political business that is now agitating not only Parliament, but the country at large.

Stand-by Clause. A Committee of the Commons, presided over by Sir Edwin Cornwall, were very busy with Bills last week. One of them was that of the Swansea Gas Company; and its appearance before the Committee was almost purely formal. Since the Bill was in the Lords, and the Company won on all essential points, they have considered whether it was possible for them to revise their works' extension plans so as to meet the Corporation in the matter of the land to the utilization of which for manufacturing purposes exception was taken. The Company desire to live in amity with the Corporation; and though they have long nursed the portion of land in dispute, with an eye to manufacturing extensions, the Engineer (Mr. G. T. Andrews) has revised his plans so that this particular piece will in future be used for storage and purposes other than gas manufacture and conversion of residual products. It is a disappointment to the Company; but they (and it was diplomatic) did not desire to set themselves in the matter in direct opposition to the Corporation. This practically cleared the path of all hostility to the Bill. But there was the Local Government Board. The Board, flying in the teeth of justice whenever the stand-by clause comes up in a Gas Bill, called attention to the one framed by the Company. The Company asked power to charge up to a maximum of 25s. per quarter to those who use their meters and pipes for stand-by purposes, while employing some other means of satisfying their requirements. Sir Edwin Cornwall regarded the clause as oppressive and unreasonable. It is difficult to find the reasoning underlying the stricture. Would Sir Edwin like to spend a large amount of capital, at the instance of whoever might make the demand, for the purpose not of regular business, but merely adventitious, and thus probably have the capital lying idle for long periods without earning anything, or without compensation? We think not. Where then do oppression and unreasonableness come in? In the event, the Committee decided that the charge should not be imposed in the case of users for domestic purposes only.

Steam-Rollers. The Hertfordshire County Council have been very tenacious in trying to get a clause in the Uxbridge Gas Order that would give them protection against any liability in the case of damage to the Company's mains by the use of a roller of a weight up to 15 tons. They have

tried at every stage of the Order to obtain the provision, and have failed. They were before a House of Lords Committee in July; and the Lords would not give them exemption from liability under the terms laid down. The Council appeared again before Sir Edwin Cornwall's Committee last week. Once more they were refused special protection. The Committee saw from the evidence of Mr. H. E. Jones and Mr. Charles Carpenter the unreasonableness of the proposal. Mr. Carpenter put the matter in a nutshell when he said that the effect of the Council's clause would be to deprive the Company of their common law right by stopping the Courts from deciding what was reasonable or unreasonable. He regarded the use of a 15-ton roller as a retrograde step. The Committee gave tacit endorsement to these views by stating their opinion that the Council did not require special protection.

Margam and Aberavon. The Margam District Council have succeeded with their Bill under which they have secured the right to purchase the portion within their territory of the gas undertaking of the Aberavon Corporation. The Lords Committee, however, who had the final say in the matter, considered that, when compensation was awarded, due consideration should be given to the fact that a certain amount of the existing gas plant of Aberavon would be rendered surplus; and they further stipulated that a month's notice to terminate the supply should be given. The relations of the Aberavon Corporation with Margam were painted about as black as was possible; and in this matter generally the people of Aberavon have received scant consideration. There was a more economical way in which identity of interests in regard to the gas supply of Margam and Aberavon could have been established, without going to the extravagance of having separate works for the supply of two places that (as Mr. Corbet Woodall said) are practically one. The expert witnesses for Margam were Mr. Frank Jones and Mr. E. Herbert Stevenson. In addition to Mr. Corbet Woodall, Mr. John Mogford, of Briton Ferry, gave evidence for Aberavon.

Merthyr Tydfil Water. The protracted discussion over the Merthyr Tydfil Corporation Water Bill has come to an end; and there has been no substantial alteration in the measure. The promoters have guaranteed a supply of water to the Rhondda for fifty years; and the Pontypridd and Rhondda Board have, in association with this, secured the right over that period to construct a new reservoir.

Charco, Limited.

At an extraordinary general meeting of the shareholders of Charco, Limited, which was held last Thursday at the registered offices, Winchester House, Old Broad Street, E.C., it was decided to increase the capital from £21,000 to £35,000, by the creation of 14,000 further shares of £1 each. It is, however, not intended to make any issue of shares in connection with the matter. The Company have, we are informed, hitherto confined their attention to the completion of patents and arrangements for handling the red-hot coke as it comes from the retorts or coke-ovens, so as to produce "Charco" speedily and economically. This, it is said, has now been accomplished, and licences for manufacture may soon be completed.

"Electric Weld" Combination Boiler & Gas Water-Heater.

We understand that there is being placed upon the market a special form of combination boiler and gas water-heater of American manufacture, known as the "Electric Weld." The apparatus is self-contained. The heating chamber, being entirely surrounded by water, prevents any possible heat leak. It is made in a variety of sizes, adapted to the requirements of a small villa or flat and to the needs of large users, such as hotels, hospitals, and other places, where an unlimited supply of hot water is always in demand. The fixing of the apparatus is simplicity itself. It takes up very little space, and is entirely void of any delicate or intricate parts. The initial cost is small; and the maintenance reduced to a minimum. It has a double circulation, which is not to be found in many other makes of heaters. There is automatic or intermittent service, optional to the user without adjustment of the parts or breaking connections. The cylinder, which is of steel, and electrically welded, and is thus rendered specially strong, is guaranteed to a working pressure of 150 lbs. This pattern lends itself to direct coupling with the back boiler of an ordinary range, or it can be used independently as a gas-heater. The burner is of the bunsen type; and the heating coils are formed of brass sections—hollow six-limbed crosses of cast brass—which are arranged in such a way that the heat from the burner impinges against each separate column from top to bottom. The circulation of the "Electric Weld" boiler is claimed to be very rapid, both in the coils and within the boiler. As a result, the whole contents of the boiler are heated at practically one and the same time. An essential detail is the provision of a "thermo-valve," which is introduced into the base of the boiler in such a fashion that the incoming water impinges directly upon the thermostatic column. It follows that the latter responds immediately water at the taps is drawn; and the movement transferred from the gas-valve is exceedingly sensitive. A special feature of the "thermo-valve" is the arrangement whereby it can be brought into play at any predetermined temperature of the water desired.

CITY AND GUILDS EXAMINATIONS.

The Prize Winners.

In the "Journal" for the 27th of June (p. 1008), the list was given of the candidates who passed the last examinations in "Gas Engineering" and "Gas Supply" in the Department of Technology at the City and Guilds of London Institute. We have now received from the Superintendent of the Department (Sir Philip Magnus, M.P.) a list of the prize winners in the subjects named, as well as in those of "Coal-Tar Distillation and Products" and "Heating and Ventilation;" and the following are their names, and the centres at which they studied.

Gas Engineering.

Honours Grade.—First prize (£3 and a silver medal), Frank Laurence Bassett, East Ham Technical College.

Ordinary Grade.—First prize (£2 and a bronze medal), Harold Joseph Hailstone, Birmingham Municipal Technical School; second prize (£1 10s. and a bronze medal), Allan Baker, Regent Street Polytechnic; third prize (a bronze medal), Edward William Bennett, Regent Street Polytechnic.

Gas Supply.

Honours Grade.—First prize (£3 and a silver medal), Stanley Barker Johnson, Hull Municipal Training College.

Ordinary Grade.—First prize (£2 and a bronze medal), William Heathcote, Liverpool Municipal Technical School; second prize (£1 10s. and a bronze medal), Walter Edwin Oulds, York Technical School; third prize (a bronze medal), Fred Rothwell, Reading University College.

Coal-Tar Colouring Matters.

Ordinary Grade.—First prize (£1 10s. and a bronze medal), Victor Hobson Goldthorpe, Huddersfield Technical College; second prize (£1 and a bronze medal), George Green Hopkinson, Bradford Technical College; third prize (a bronze medal), Louis Dennis, Halifax Municipal Technical College.

Heating and Ventilation.

Honours Grade.—First prize (a silver medal), Robert Ratcliffe, Bacup Technical School, and George Twist, Doncaster Municipal Technical School (equal).

Ordinary Grade.—First prize (a bronze medal) Harold Wallace, London County Council; second prize (a bronze medal), Sydney Vernon Drew, London County Council.

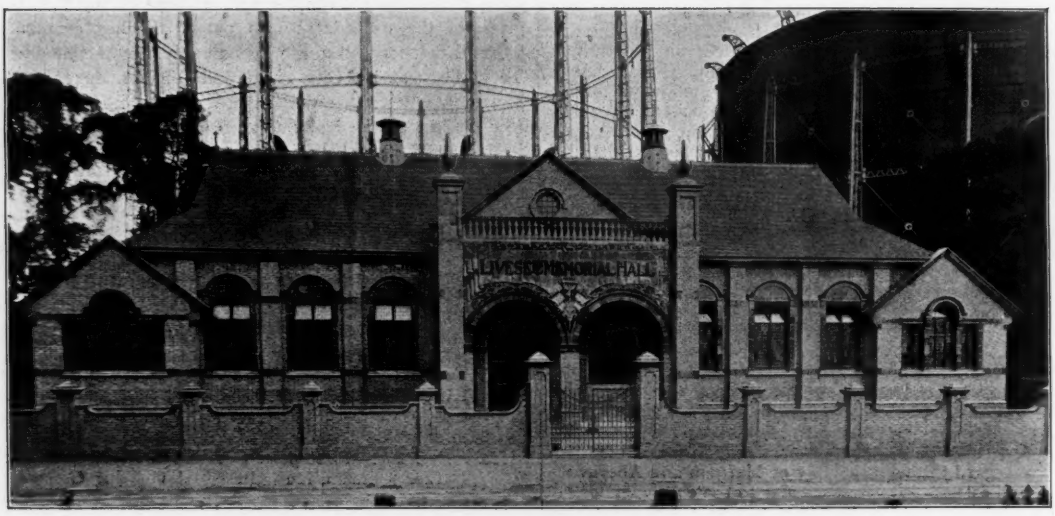
The money prizes in "Gas Engineering" and "Gas Supply" are given by the Goldsmiths' Company, those in "Coal-Tar Distillation and Products" by the Salters' Company.

Presentations to Mr. and Mrs. Samuel Glover.

There was a pleasant gathering of about two hundred of the officials and workmen of the St. Helens Corporation Gas Department at the works last Friday, under the presidency of Mr. R. Sterritt, to commemorate the forty years' service of the Gas Engineer, Mr. Samuel Glover, and to testify their esteem for Mrs. Glover. The Chairman said they had every reason to be proud of Mr. Glover. He had steered the ship for a good many years in a very successful manner. They were pleased to have Mrs. Glover present, because they knew how great was the interest she took in their welfare. Mr. Glover had completed forty years' service; but his energy had not abated in the least, and his ability was greater than ever. The St. Helens Corporation not only acknowledged this, but it was acknowledged throughout the country. Mr. J. W. Allin, the Chorley Corporation Gas Engineer, and formerly Mr. Glover's Assistant at St. Helens, said the spontaneous way in which the idea of the presentation had been taken up was a striking tribute to Mr. Glover's popularity. He (Mr. Allin) attributed what success he had met with to the careful training he had received at St. Helens. Mr. E. M. Hollingsworth, the Electricity Engineer of the St. Helens Corporation, who also commenced his career under Mr. Glover, bore testimony to the great help he had been to him, and said that Mr. Glover's main characteristics were certainly kindness, energy, and ability. Mr. H. Rudge, the Gas-Works Chemist, then presented to Mr. Glover a handsome illuminated address, and to Mrs. Glover a massive salver bearing the following inscription: "Presented by the officials and workmen of the St. Helens Corporation Gas Department to Mrs. Samuel Glover, in commemoration of the association of Mr. Glover for forty years with the St. Helens Gas-Works. July, 1911." Mr. Glover, who was heartily cheered, spoke of the pleasure the gathering gave him, and thanked all those who had worked in so loyal and helpful a manner all the time they had been associated with him. He considered that the presentation was one of the greatest honours that could be conferred upon him. During the evening, the officials and workmen were entertained at tea by Mr. Glover; the gathering being in every respect most enjoyable and successful.

THE LIVESEY MEMORIAL HALL

At the Works of the South Suburban Gas Company.

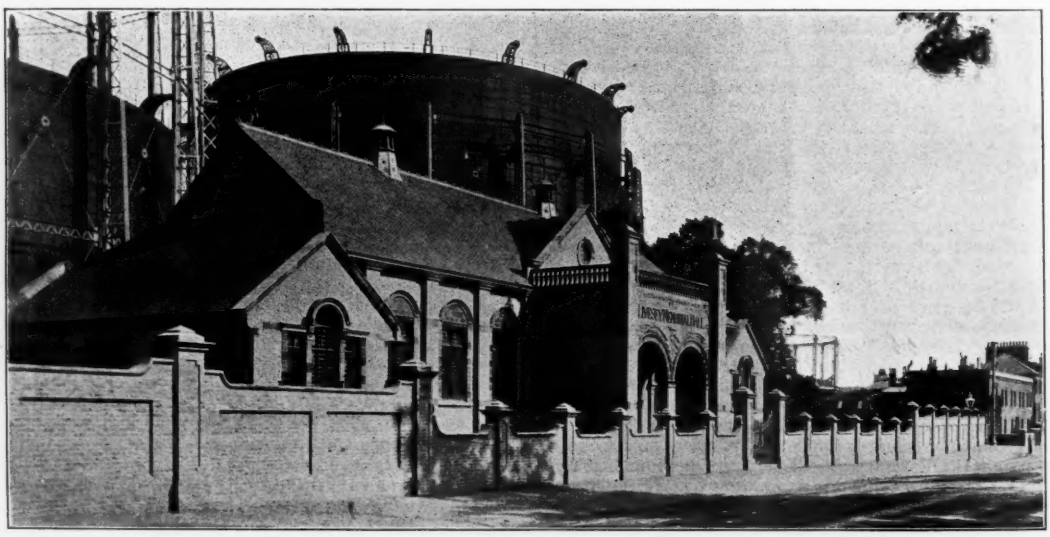


Front View of the Livesey Memorial Hall, Lower Sydenham.

A WORTHY memorial to a worthy man. That is the uppermost thought as one leaves a new building (to be known as "The Livesey Memorial Hall") and recreation grounds that now grace Lower Sydenham and the works of the South Suburban Gas Company. The Chairman (Mr. Charles Hunt) and Directors of the Company, the Engineer and Manager (Mr. S. Y. Shoubridge), and the Secretary (Mr. C. M. Ohren) know, without reference to the records, what the Company owe to the administrative powers of Sir George Livesey, and the whole of the employees have a deep-seated affection for, and sense of gratitude to, the man who was instrumental in giving them new interests in life and work through co-partnership. They recognize that where duty in business was concerned, their late Chairman was a conscientious disciplinarian and strict in his dealings, with an eye ever on the trust reposed in him. But all knew him by his many overt deeds (and there was much that was done privately) to be a large-hearted humanitarian. And the greatest of his works was co-partnership. Company and workers therefore desired to have in their midst —it was a very natural desire—a fit memorial to Sir George—a memorial that in itself should represent his characteristics. He was strong; the building is likewise. He was large-hearted; the building is spacious. He was careful in matters of detail; the building for its purposes has not a single necessary item omitted. He was a great believer in healthy recreation for the hours of leisure. Here we have for entertainments a large hall of which many a town would be proud; here there is a room for billiards that would not disgrace some of our West-end clubs; here is a reading-room where the movements and affairs of the outer world can be quietly studied; here we have for the summer time a magnificent bowling-green, second to none in the South of London; and here, too, is the ground now being laid out to serve the purpose of tennis courts.

The acts of Sir George during his lifetime endorse this provision for recreation. He was always interested in the workmen's recreation clubs attached to the companies in which he was concerned. We remember the bonus days of long years ago, and how, after speech-making was over, he showed a personal interest in the games and fun of the day. The usually grave face would be radiant with laughter and merriment. We bring to mind, too, how, even in closer years, his tall figure might be seen among the employee co-partners of the two South London Companies, on co-partnership day, in the Crystal Palace grounds, and even sharing, with almost boyish delight, in the amusements there provided. He could enter, with a vast and keen enjoyment, into genuine recreation and relaxation at the proper time with the same enthusiasm and ardour that he entered into his work and interests generally. He was a leader in a great industry, and a broad-minded leader of men; and all who were directly or indirectly associated with him cannot do too much in keeping his name and example green, and in furthering the good work that he initiated. This Sydenham memorial will do its share. In the years stored deep away in Time, when those who were contemporaries and associates of Sir George have passed hence, this building will assist in reminding of the man and of much that he did. It will show how greatly he was beloved by those who moved with him. From father to son there will pass, through the memories and interests awakened by the existence of the hall, the story of a life work having for its chief ambition the benefit of the gas industry and of its workers; and the telling of the story, and the presence of the building, must—nay, will—prove an incentive to good through many generations to come.

We need not here say a word as to the amount of credit due to the Chairman and Directors for the liberal powers placed in the hands of the Engineer (Mr. Shoubridge) in connection with the memorial. They endorsed the whole of the plans with the same



A Front View of the New Buildings taken from the Reading-Room and Library End.

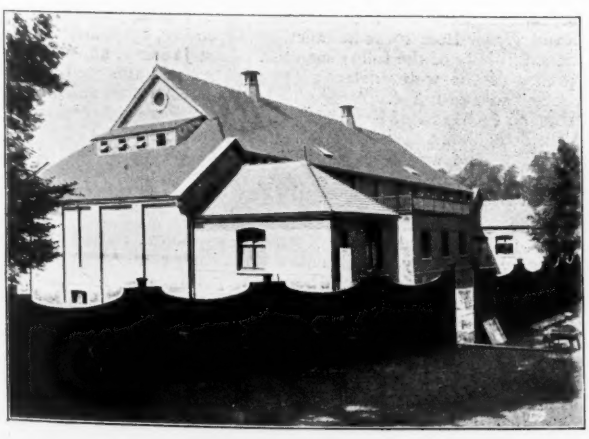
willingness and pleasure that they would have done those for a necessary works' extension. No member of the directorate even allowed a thought as to outlay to trespass upon this particular duty and pleasure in what they were doing. The one idea was a memorial fit, reasonable, and useful, and one of which the Company might hereafter be proud. The work is done. The Engineer and his staff have properly and fully interpreted the desire of the Directors, and the numerous workers of the Company are gratified, and not only they but the neighbourhood generally. Probably no other gas-works can claim so handsome a place of such generous capacity for purely recreation purposes. Facing Perry Rise, the building and its surroundings are an ornament to the locality. In front we have a nice boundary wall; and artistically designed double iron gates leading up to the main entrance of the building, which is set in the midst of the extensive bowling-green, the tennis courts, and other turfed ground, all of which eventually will have trees planted on their borderings for shade, and here and there, in suitable positions, there will be the relief and picturesqueness to be afforded by well-planted flower-beds. The site of the whole is taken from the part of the gas-works ground adjoining the holders, from which it is separated by a tall, lightly-paled, oak fencing, with gateways leading on to the works. While making note of these points, it may be mentioned that the bowling-green is 124 feet by 54 feet in area; and the tennis courts at the opposite end of the building occupy a ground area of 16,000 feet. It is all a little oasis in Lower Sydenham.

Interior of the Large Hall—Looking towards the Stage.

Description of the Building.

We turn to the building itself. As to its architectural features, the lines of its design are graceful, and the whole has a very picturesque effect. The photographs will do more to show this than any number of words in description and praise. The building covers 6830 superficial feet, and its walls are composed of stock bricks made on the works by the Company's men, with terra-cotta dressings, supplied by Messrs. Burmantofts, of Leeds. The roof is covered with sand-faced red tiles with finials at ends, supplied and fixed by Mr. C. Collins, of Staines. Over the main entrance is a handsome faïence panel, bearing the words "Livesey Memorial Hall," in three colours, the letters being in relief. The front boundary wall (which runs the full length of the building and grounds) is built in similar materials to match the new building—viz., best stock bricks panelled with red borders and terra-cotta caps and coping, supplied by Mr. J. C. Edwards, of Ruabon. The main entrance gates were made and supplied by Messrs. W. Macfarlane and Co., of Glasgow. The fencing forming the back boundary runs parallel with the front wall, and is (as previously said) constructed of oak with elliptical coping. Though the names of contractors for certain parts have been mentioned, the employee co-partners of the Company—beneficiaries of Sir George's work—have carried out the main parts of the construction. As already stated, the bricks and artificial stone were made on the works. To the Company's men also is due the execution of the concrete foundations and the construction of the brickwork of the building and boundary wall, the carpentering work in the making and erection of the roof, doors, windows, and the laying out of the tennis courts and bowling-green. Everything has been well and truly done; and in the high-class work and finish, there is plainly printed, as though in black and white, the feeling of every man that nothing but his best was worthy a place here.

Passing in at the main entrance portico and vestibule, the thoroughness and completeness reposing in design and work that have struck one outside are found carried throughout the building. Not an essential is omitted. The portico itself is rather more than 27 feet long by 3 ft. 6 in. wide; and the vestibule (including a hat and cloak room) is 26 ft. 4 in. long by 9 ft. wide. The floors of both portico and vestibule are laid in Venetian Terrazzo marble, by Messrs. Burke and Co., of Rathbone Place, W. The main door on the right from the vestibule leads to the large concert hall and the main doorway on the left leads to the billiard and recreation room, together with the reading-room, the Committee-room, and the lavatories.



A Back View of the New Buildings—Taken from the Bowling-Green End.

Here we are in the concert hall—a hall whose features as they are picked out by the eyes one by one in the end evoke the expression of appreciation in the single word "magnificent." The hall is 51 ft. 6 in. long by 40 ft. wide, and is designed to accommodate about 450 persons. The audience seated in this lofty and spacious hall will face a stage at one end, 44 ft. long by 17 ft. wide, fitted with a footlight screen (20 ft. long), lighted by eighteen incandescent burners. The ornamental proscenium opening is 34 ft. wide and 16 ft. 6 in. high. This capacious stage is being fitted with scenery, drop curtain, and all requisites for entertainment and effect. We can foresee many a pleasant evening provided from this stage; the Company having some good musical and dramatic talent among the employees. There is ample window area for lighting the hall in the daytime. The ventilation has likewise been abundantly considered. In the walls of the body of the hall, there are eight fresh air ventilating panels, and two are fixed in the back wall of the stage. Centrally situated in the beautiful ribbed and coved ceiling of the hall is a sunburner of Sugg's make, fitted with a cluster of 21 Graetzin inverted burners; and connected with the sunburner is a tube running up to the apex of the roof, on top of which is fixed one of Shorland's patent exhaust ventilators. This arrangement conducts away the products of combustion from the burners, and at the same time the foul air of the room. The hall is further illuminated with ten two-light wall brackets. Connected to the platform by a short passage are two dressing-rooms, each 12 ft. 7 in. by 10 ft. 1 in., both provided with lavatory accommodation. In the hall itself liberal attention, it was observed, has been paid to the exits.

Passing from the hall, we find ourselves in the billiard and recreation room, which is 39 ft. 3 in. long by 40 ft. wide. The general features harmonize with the hall just described. It was noticed that the windows are composed of tinted glass leaded in diamond shape; and while the lighting is good in the daytime, any glare there might be with ordinary windows is removed by this particular form of glazing. This room is also lighted by two Sugg sunburners fixed in a coved and ribbed ceiling; each fitting being furnished with a cluster of nine inverted burners. Again the ventilation has received very generous treatment. There are six fresh-air ventilating panels in the side walls, and the foul air is extracted in similar manner to that adopted in the concert hall. The room is of area sufficient for three full-sized billiard tables; but two full-sized ones and a small one have been provided. On two sides of the room portable platforms have been arranged, on which are leather-covered settees and tables. This room will serve as a big counter-attraction to places where billiard rooms are provided for business purposes.

From the billiard and recreation room, entrance is obtained to the reading room. This has an area of 33 ft. by 16 ft. 6 in. It contains three tables, at each of which six persons can be accommodated. The equipment also includes a set of bookcases supplied by the Globe Wernicke Company, Limited.

In the remainder of our examination, everywhere was found the attention to detail on which we have previously commented. There is a Committee room 14 ft. 9 in. by 16 ft. 1 in.; and this will be immensely useful. A refreshment room is situated on the further side of the building opposite the main entrance. It is so designed as to be common to the concert hall and recreation room; and there non-alcoholic and other refreshments of all kinds will be supplied. The room is provided with a counter, hot water urn,

water supply, sink for washing-up, &c. The lavatory is 12 ft. 6 in. by 10 ft. The floor is laid with Venetian Terrazzo marble. All the fittings are by Messrs. Finch and Co., of Lambeth.

The whole building is provided with a system of low-pressure hot-water heating apparatus of ample capacity. The plant itself consists of a cast-iron Strebel sectional boiler, water-supply tank, cast-iron flow-and-return pipes, and twelve radiators, supported on cantilevers from the wall, and distributed in the various rooms.

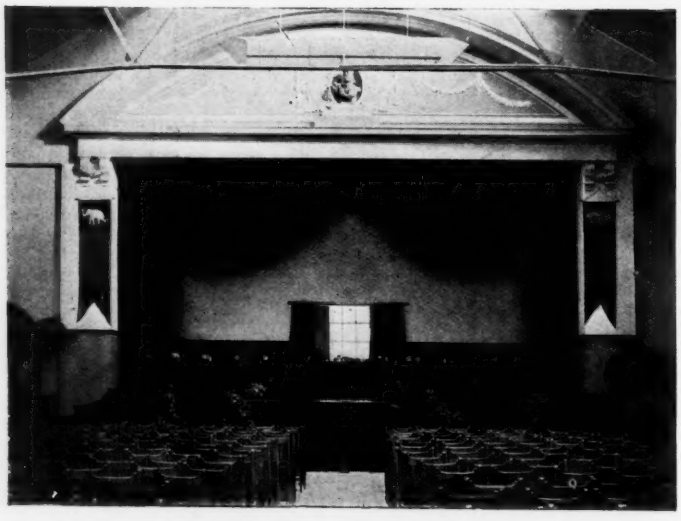
Well done! May the new Livesey Memorial Hall, at Lower Sydenham, have a long career of salutary usefulness. We have travelled far and wide among gas-works; but never have we seen a superior building in them devoted to recreation.

EAST GREENWICH AND ORDNANCE WHARF INSTITUTE.

We are publishing this week an illustrated description of the Livesey Memorial Institute at Lower Sydenham, and it will be interesting to supplement this with photographs of the East Greenwich and Ordnance Wharf Institute of the South Metropolitan Gas Company, which was opened by the Chairman, Mr. Charles Carpenter, on the 12th ult., as recorded in the "Journal," at the time (see p. 186). It was stated then that the main feature of the building is the hall, which will seat about 800. There is an ample stage, the opening of which is (as will be noticed) surmounted by a bust, in high relief, of the late Sir George Livesey; while at the rear are spacious rooms which may be used for purposes connected with entertainments or as committee-rooms. There is a billiard-room, a miniature rifle-range, and a recreation room in connection with the refreshment department; and the kitchen and lavatory arrangements are complete.

The accompanying photographs appear in the August number of the South Metropolitan Company's "Co-Partnership Journal," to the courtesy of the Editor of which (Mr. W. T. Layton) we are indebted for the loan of the blocks and for permission to reproduce them.

East Greenwich Institute—General View.



East Greenwich Institute—The Platform.

William Sugg and Co., Limited.

The vacancy in the management of this Company caused by the death of the late Managing-Director, Mr. E. Sugg Wright, referred to in the "Journal" a few weeks ago, has been filled by the appointment of Mr. Stanhope Evelyn Thornton, Assoc.M. Inst.C.E., as Managing-Director, and of Mr. William G. H. Mattock, as General Manager. Mr. Thornton has been a Director of the Company for several years, and has latterly filled the position of Chairman, which he now vacates in favour of Mr. R. W. Kennard, D.L., J.P., of the Falkirk Iron Company, and the Blaenavon Iron Company, who has also been a member of the Board of William Sugg and Co. for many years past. Mr. Mattock has spent the whole of his business career in the service of the Company, and received his training as an engineer under the late Mr. William Sugg. He has held several important positions—the most recent being that of Works Manager; and in his various capacities he has been brought into intimate contact with many of the leading members of the gas industry. During recent years, the Company have been progressively successful; and it is hoped that the changes now made will contribute to their continued and increased prosperity. To fill the vacancy on the Board, Mr. William Stevens Brown, the former Secretary of the Company, has been elected a Director.

Braces for Retort-Settings.

A patent has lately been taken out for France by Herr Aug. Klönne for a method of bracing retorts, more especially inclined ones or chambers which are built very high, and in which the vertical bracing bars are very long in front and rear. As these bars cannot be secured otherwise than by cross-bars at the top and bottom, they must be unusually heavy. Endeavours have been made to brace them together in the centre. In this case, however, two cross-bars had to be run through the masonry; and they were soon burnt. To remedy this defect, the inventor provides around the setting circular beams which enclose the vertical bars at a suitable height. Between these bars and the beams there are springs which yield under the action of expansion and contraction of the settings. It is claimed that considerable economy in weight can be effected by means of the invention.

Manchester Corporation and the Gas Publicity Scheme.—The Manchester City Council at last Wednesday's meeting confirmed without discussion the resolution of the Gas Committee that Manchester should subscribe to the scheme of the Publicity and Special Purposes Committee of the Institution of Gas Engineers on the basis of 2s. 6d. per million cubic feet of gas made. As stated in the "Journal" last week, this is subject to the Gas Department being "satisfactorily represented" on the Committee, and to the question of the basis of contribution being brought forward at the expiration of three years for reconsideration and for revision if necessary.

Sterilizing Water by Chloride of Lime.—The chloride of lime process for sterilizing the water from the Zwartkopjes wells of the Rand Water Board was installed in November, 1909, and discontinued in May of the following year. Last January, however, the quality of the water deteriorated slightly, and the sterilization process was resumed. After a number of tests, it was found that from 56 to 60 lbs. of lime added to the average daily supply of 4,500,000 gallons gave the most satisfactory results. The cost of sterilizing the water, as given by Mr. W. Ingham, the Chief Engineer, in his last annual report, is approximately 4s. 2d. per million gallons.

Underground Water in Central Australia.—In the August number of the "Journal of the Royal Geographical Society," Professor J. W. Gregory, F.R.S., completes a study of the flowing wells of Central Australia which he began in a previous issue. He points out that the discovery in Eastern Central Australia of deeply buried water, which is under such pressure that it flows to the surface when reached by a borehole, has effected a great economic change in the wide areas thus supplied. The water has so far proved inadequate for extensive irrigation, for which its quality is often unsuitable; but it is of incalculable service for domestic purposes, for watering stock, and for maintaining stock routes. The general distribution of the water ranges through an area of some 580,000 square miles.

INTERNATIONAL PHOTOMETRIC COMMISSION.

Third Session at Z rich.

FOLLOWING upon the report which appeared in last week's "JOURNAL," of the general proceedings of the third session of the International Photometric Commission, we publish in this issue other papers that were read, together with some of the observations that were made upon them and various matters that came up for discussion.

Wednesday, July 26.

The first paper that was taken was by Dr. Eitner. It dealt with the photometric methods used in Germany. A translation of this contribution will be found at page 357. With regard to the passage in it where it is said that Dr. Bunte proposed to invite representatives of different countries to make a report on their photometric methods, the President (M. Th. Vautier) called to mind that a very similar request had already been made in the 1903 session, as well as in 1907, but that it had not produced any result. Dr. Eitner's report again raised the question, and would serve as a basis for the new inquiry asked for by Dr. Bunte. As regards the measurement of the energy taken by the electric lamp used for comparison, it was asked why Dr. Eitner thought the measurement of tension at the terminals of the lamp was subject to great errors. The reply was: By reason of the accidental resistence which bad contacts could produce, it was safer to measure the intensity of the current. M. Laporte agreed with Dr. Eitner, but thought it was not very difficult to avoid this inconvenience. In any case it was better to measure the tension and the intensity. Two methods of measurement were indicated by Dr. Eitner; and the President asked to which he gave the preference. The reply was: To the second. The first method was preferably used when lights of great intensity had to be measured. M. Laporte said that the method which consisted in placing the secondary standard lamp at a fixed distance from the photometer of whatever kind offered the great advantage that the photometric screen received the amount of light for which the eye was most sensitive. To avoid the drawback which there was in moving a secondary flame-standard at the moment of measuring, an electric lamp could be adopted as the secondary standard. However, the second method is that most generally adopted, and is preferable. It lends itself, also, to the measurement of rather powerful lights. In such case, the amount of light thrown on the screen by the standard lamp is increased by choosing a standard lamp of suitable intensity, which enables, for example, the obtaining on the screen of a light of 20 to 50 lux. These are advantageous circumstances, seeing that above 10 lux difficulties arising from differences of colours become weaker. The conditions are unfavourable when the illumination on the screen is lower than 10 lux. Dr. Brodhun would not use an illumination greater than 30 lux. For the higher intensities there could be advantageously used a diaphragm of a diameter less than that of the pupil. As regards the methods described above, he never adopted the simultaneous movement of the secondary standard and the photometer. In Switzerland, Dr. Ott said, both methods were used according to circumstances, always with a fixed standard. Mr. Butterfield remarked that in England the method adopted was either a fixed distance between the two sources to be compared, with the photometer screen movable, or the fixed distance was maintained between the screen and the Vernon Harcourt, or the secondary standard with the method of substitution. It was therefore the lamp that was being tested which ought to be moved.

With regard to the flicker photometer, it was remarked that this kind of apparatus has met with certain criticisms. Dr. Eitner said, however, that for industrial measurements the results were accurate to within about 2 per cent. M. Laporte had used, without difficulty, the Brodhun photometer for comparing the arc light with the incandescent lamp, and recommended it for this purpose. Mr. Butterfield said that in England, when it was desired to compare lights of different shades, one used a Bunsen star-spot photometer or a flicker photometer. The old grease-spot Bunsen was preferred to the Brodhun photometer for lights of the same shade.

As to the average horizontal intensity, M. Laporte said that to measure it with electric incandescent lamps, the lamp could also be turned on its axis. Dr. Brodhun avoided this because it was necessary to turn it rather quickly, which might alter the intensity. But this method had begun to be used for metallic filament lamps, because in their case, by reason of the great number of threads, it was not necessary to turn it very quickly. M. Laporte added that for carbon filament lamps, three turns per second were quite enough, and this was not very inconvenient. Dr. Brodhun replied that in any case a certain amount of care was required with this method.

The average spherical intensity was next referred to; and Dr. Strache said that in Austria for lamps of great intensity the Brodhun photometer for street measurements was exclusively used. It was to be observed that in reflective lamps the law of distances was no longer valid. The lamp was placed so that its distance from the photometer was always 2 metres. When the lamp was large (reflector, 0·50 m.), the method based on the law of distance was no longer valid. Mirrors of 5 metres were necessary, which was not practical. Dr. Eitner said that the method of Dr. Strache was a special method, because with it apparatus fitted with large mirrors was needful. Dr. Ott used the Martens apparatus, which was convenient for reflectors of 500 mm. diameter. M. Laporte gave the information that at the Central Laboratory of Paris, when they measured arcs provided with globes they used a mirror which was about 500 mm. one way by 800 mm. another.

For the average spherical intensity of gas-lamps, Dr. Strache said the spherical photometer could not be used because the air became vitiated. The Rousseau method was too long. They took measurements in the chosen directions (more horizontal than vertical) proportionally to the sines of the inscribed angles, and the average spherical intensity was got by dividing the addition of the measurements by ten. M. Laporte said that, theoretically, there was an apparatus, the mesometre, which gave the average spherical intensity by a single measurement. It had been described in France by Leonard, and in England by Russell. A series of mirrors fixed at an angle of 45° was arranged about a circle proportionally to the sines of the angles. Dr. Strache said that each mirror ought really to be of the total size of the lamp; and, in his view, it was necessary to know the coefficient of the reflection of each mirror in relation to the angle of incidence. Dr. Eitner added that these measurements could not be so accurate as the preceding ones. Dr. Ott asked at what distance from the ground it was necessary to take the measurements—1 or 1·50 metres? Dr. Brodhun replied that in Germany gas engineers measured at 1·50 m.; the electricians, at 1 m. M. Weiss suggested that it was desirable to arrive at an agreement as to this height. Mr. Butterfield said that in England, a Committee was examining the question; but up to the present no report had been made. It was composed of gas engineers and electricians, and had been nominated by three Societies—the Institution of Gas Engineers, the Institution of Electrical Engineers, and the Illuminating Engineering Society. The President then thanked Dr. Eitner for his interesting paper, which would be sent to the technical societies participating in the Commission and to the National Laboratories—at the same time asking them to make observations and suggestions upon it. A *résumé* of the replies would be distributed among the members, so that conclusions could be come to at the next session.

The President then announced that M. Sainte-Claire Deville had brought a burner which was intended to measure the absolute flame lighting power. The gentleman referred to lighted the burner and explained its working, and gave some interesting information concerning it. An extract of the results obtained will be published in the "Transactions" of the session. Meanwhile, it may be mentioned that the burner was described and illustrated in the "JOURNAL" for March 28 last, p. 916.

Thursday, July 27.

Mr. Butterfield read the paper, on the "Corrections for the Effects of Atmospheric Conditions on Different Photometric Flame Standards," which was given in last week's "JOURNAL," p. 288.

M. Brodhun remarked that a criticism of the paper was for the moment impossible. One could, however, be glad that the results were not contradictory to those ascertained before. It was only as regards high pressures that there was any disagreement at all with MM. Liebenthal and Paterson on the subject of the Harcourt and Hefner standards. It seemed that in the tests the chambers were too small; so that it was necessary to make permanent corrections. Moreover, the curve showing the influence of pressure exhibits an incomprehensible bend. It was certainly a question to be elucidated. The President asked if tests had not been made under natural conditions, but at high altitudes—800 to 1500 or 2000 metres. Were there such stations in Germany or Austria? M. Kusminsky replied that there was a station having gas in Austria at an elevation of 1500 metres. Dr. Strache said he would ascertain if there were suitable places in Austria which might be interesting from this point of view. M. Weiss proposed to ascertain the value for the Hefner at Zürich at the Schlieren Laboratory (470 m.), at Uetliberg (900 m.), and at Säntis (2000 m.) and at the Jungfrau, if necessary.

In reply to the President, Mr. Butterfield said there were not suitable places in England. Dr. Strache said the influence of the atmosphere could be ascertained with a comparative electric lamp. With gas-lamps and flame-standards the effect was eliminated—being the same for the one as for the other. M. Brodhun remarked, as to the influence of carbonic acid and humidity, that it was very difficult to ascertain, seeing that one is not master so as to vary these elements. Liebenthal had carried out work on the subject, which would be published shortly, but it was not in that a question of the effect of pressure. Dr. Eitner thought that the relative correction for pressure would be necessary in future tests, as one regulated the electric lamp with a Hefner.

Mr. Butterfield said he thought the experiments had been very exact; the chamber was large enough for the conditions to be almost natural; and the carbonic acid only varied 0·1 per cent. The variation of pressure did not exceed 2 mm. There was agreement with M. Liebenthal beyond a pressure of 660. Dr. Eitner called attention to a passage in a paper by M. Liebenthal, where he gave results showing how the intensity varied with the

pressure. Mr. Butterfield said tests had been made with the spermaceti candle. The results were:

At 474 mm., it gave 75 per cent. of the English candle;
,, 308 mm., ,, 40 ,, ,, ,, ,,
,, 150 mm., ,, a small blue flame;
,, 127 mm., it went out.

The President asked if Mr. Butterfield had found differences at the beginning and at the end of a test, in order to see the effect of water vapour due to the operator. Mr. Butterfield replied that an Assmann hygrometer had been used, and a variation of from 0·72 to 0·75 per cent. had been found in the moisture. The amount of carbonic acid was 0·125 at the beginning and 0·125 at the end. The President observed that gas saturated itself with water vapour in passing the meter. How could it be arranged to measure the gas dry? M. Brodhun thought it would be possible to dry the gas by collecting it in a dry holder or by using petroleum in the meter. Dr. Strache suggested that one might use paraffin by slowly turning the meter. Dr. Eitner thought it would suffice to dry by means of chloride of calcium and make the correction corresponding to the water vapour absorbed. The President hardly thought this would be sufficient, owing to the large volume of air necessary.

Dr. Colman said he had made tests, but thought that error was introduced by drying the gas, because benzene was absorbed by chloride of calcium. M. Sainte-Claire Deville was of a contrary opinion, and also, after tests made in Paris, thought the differences due to dry or moist gas negligible. Dr. Colman said that chloride of calcium, by absorbing water, gave a liquid which physically absorbed benzene. M. Sainte-Claire Deville said it was always necessary to operate with columns of dry chloride of calcium. The volume of liquid was always slight, and likewise the error. Air could also be dried by cooling it to at least 22°, with a flow of one metre per hour. The President thought the correction necessitated by the moisture, referred to by Dr. Eitner, was a fiction. How could one calculate the velocity of the moist gas from the velocity of the dry gas and the vapour? Dr. Eitner replied that if the orifice corresponded to the Bunsen law, one could calculate the rate of flow according to the density and the pressure. The President asked how the effect of the moisture on the rate of flow was to be reckoned when the temperature varied; and Dr. Eitner answered by saying that one calculated the velocity according to the densities, by taking the density of the mixture.

This concluded the morning's discussion. In the afternoon,

Dr. Strache described a method of regulating the height of the flame of the Hefner lamp by means of a thermo-couple. A translation of his communication is given on p. 358. In reply to M. Brodhun he said that a slight obliquity of the flame involved a variation in the deviation of the indicator.

M. Sainte-Claire Deville spoke on absolute lighting power. In 1903 and 1907, the Commission had, he said, considered the subject. Since then, MM. Mayer and Schmidt, at Carlsruhe, had verified the work of M. Sainte-Claire Deville by taking into account a correction of 15 per cent. for water gas. M. Sainte-Claire Deville proposed the replacing of the examination of illuminating power by that of calorific power—the latter being better defined. He asked if the Commission was sufficiently informed on the question. He thought that such substitution would be useful. Dr. Strache said he had shown that the effect of flame temperature was relative to the economy of the lighting. At Carlsruhe, it had been found that the higher the temperature the better was the result. But one had always worked by regulating the consumption for a given number of calories, instead of having a constant consumption. To investigate the effect of temperature, he had added carbonic acid, which at once lowered the calorific power and the temperature. By adding hydrogen, the calorific power was lowered, but the temperature was raised. Naturally, the volume was also changed; but by carburetting the gas, to obtain the same calorific power, the raising of the temperature was always an advantage. For example:

With 0	per cent. of CO_2	5	calories
7½	,, ,, ...	6	,,
25	,, ,, ...	9·25	,,
33	,, ,, ...	13·7	,,

With benzene, there was an increase of 6·6 to 8·1. With acetylene, a 7·07 increase was obtained. He did not combat the proposal of M. Deville; but he did not think it was necessary to admit an exact proportion between the calorific power and the lighting power. He would be glad if there were a Committee to draw up a resolution. The figures obtained in his investigations were given in detail in a paper of which a translation appears on p. 358.

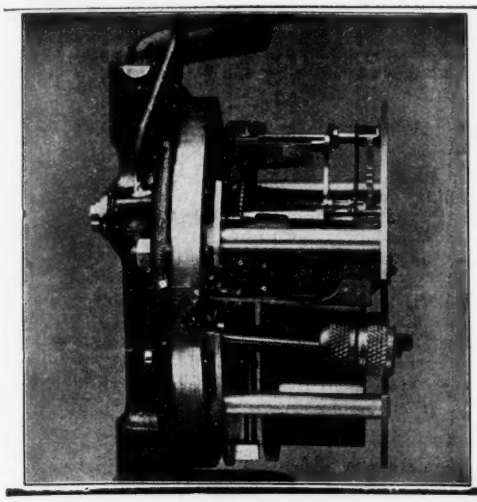
M. Sainte-Claire Deville said that Dr. Strache had not defined incandescent lighting power. It was necessary to burn each gas in a suitable burner. If not, it was needful to regulate the draught each time, in order to obtain the best result. He had used a No. 1 Auer burner by providing it with a distinct supply, and by regulating it so that whatever gas was used, the outlay of heat was the same. A test was made with a separate supply, and another with a normal one. A gas of 4000 calories requires 3·75 times its volume of air, and gives 24 litres to the carcel. A gas of 9000 calories (gross calorific value) gives 15 litres to the carcel. If artificial air is introduced, the efficiency is improved. With poor gas, there is the same outlay per carcel. With rich gas, the outlay is 11·7, instead of 15. These tests have shown that the problem to ascertain what is the power is far from being reached. When one reheats with hot air, it is rather the speed of the air than its temperature which is important. The same thing occurs with gas. The speed of the afflux of heat is the real factor. M. Deville thought he could come to an agreement with Dr. Strache in defining illuminating power. The President observed that, in fact, the calorific power described the gas better than its illuminating power. The replacing of the latter by the former was not an ideal, but was perhaps a practical, solution. A large number of Technical Societies wished it. Dr. Strache said he hoped for this substitution; but he did not agree with a statement being made of proportion between calorific power and illuminating power. Moreover, M. Deville had found that it did not exist with water gas. It would be better to omit the references to proportion. The President asked within what limit was there proportion; and M. Deville replied for all coal gas, and even with a mixture of water gas. Dr. Colman supported the view of Dr. Strache, but said it would be difficult to introduce in England the substitution asked for, because the illuminating power was stipulated by law, and only in a special case was there reference to both calorific power and to lighting power. The Institution of Gas Engineers would oppose any extension of this dual test.

Mr. Butterfield, at the President's request, explained the functions of the Gas Referees, and said that in the case quoted the lighting and the heating power were both ascertained every day. If they were not satisfactory, there was a penalty. Dr. Colman added that English engineers were not opposed to the introduction of calorific power, but only to having two stipulations. Moreover, they could not make the proposal to Parliament. M. Böhm thought the tests of MM. Strache and Deville were not comparable. Dr. Eitner said that it would be necessary to take into account the burner in the definition of illuminating power. The flame ought to be such that it exactly filled the mantle. In Germany, the substitution would be effected gradually. With this view, they had there begun to allow a calorific power of between 5000 and 5200 calories per cubic metre; the illuminating power being 10 to 12 Hefners per 150 litres. Dr. Colman advocated the fixing of the definition of calorific power, if they adopted the resolution concerning it. The President said they should adopt the calorific power of the physicists. Dr. Colman said the heat of combustion was the gross calorific power. M. Deville thought one ought to consider the water as vaporized [Session 1903], in conformity with the Jünkers indications. In summer the results were different from winter. Both the President and M. Deville considered it better to keep the definition of 1903. Dr. Strache said that in Austria they had begun to accept the gross calorific power. He proposed that the International Photometric Commission recognize the heat of combustion as a fundamental measurement, and that the illuminating power remains outside the resolutions, as the gas is used for lighting, heating, and for motive power. The President thereupon proposed a Sub-Committee, who were appointed, consisting of MM. Deville, Eitner, Weiss, and Colman, to consider the scheme of this proposal.

The Commission later on expressed their opinion that, having regard to the methods of employing gas at present in vogue, the determination of the illuminating power of gas-flames has lost its significance, and that the determination of calorific power ought to take the place of the determination of illuminating power as the essential criterion of the value of gas.

The Commission then passed to the consideration of internal administrative matters, such as the increase of the members. The President cited the example of the electricians, who gave only one vote to each country, whatever the number of delegates. He proposed to give to each country as many votes as it had representatives. M. Brodhun pointed out that they could not come to a decision, as they had not the views of the societies of which they were delegates. Dr. Strache suggested that they discuss the number of members, and then the method of voting. To come to a decision relating to the unit of luminous intensity, it would be necessary to have the electricians associated with them. Dr. Colman thought it best to discuss first the method of voting, or to discuss both questions together. If the number of members was increased, the solution would depend on the number present. It would be the same if the number of votes was equal to the number of delegates. It would be otherwise if each country had one vote. M. Kuminsky said that the societies with which he was connected voted by countries. The President said that as certain decisions might have a commercial interest, it would be logical that the number of representatives be proportionate to the population. In any case, regard should be had to the importance of the countries. Dr. Colman opposed a vote according to the number of members present.

After further discussion, the Commission voted unanimously in favour of a vote by countries. They then passed to the consideration of the increase in the number of members. Dr. Strache proposed to leave it to the societies to send whatever number of delegates they pleased. It would be necessary to see what should be the financial contribution of each country. It would be logical for the societies to pay in proportion to the number of their delegates. Mr. Butterfield thought, however, that a limitation of the number of members would be useful. Dr. Eitner considered that the increase of numbers would lead to want of unanimity. It would be better to increase the number of delegates of countries which had but one, and even two per country was too few. M. Weiss said each country ought to be invited to send up to six



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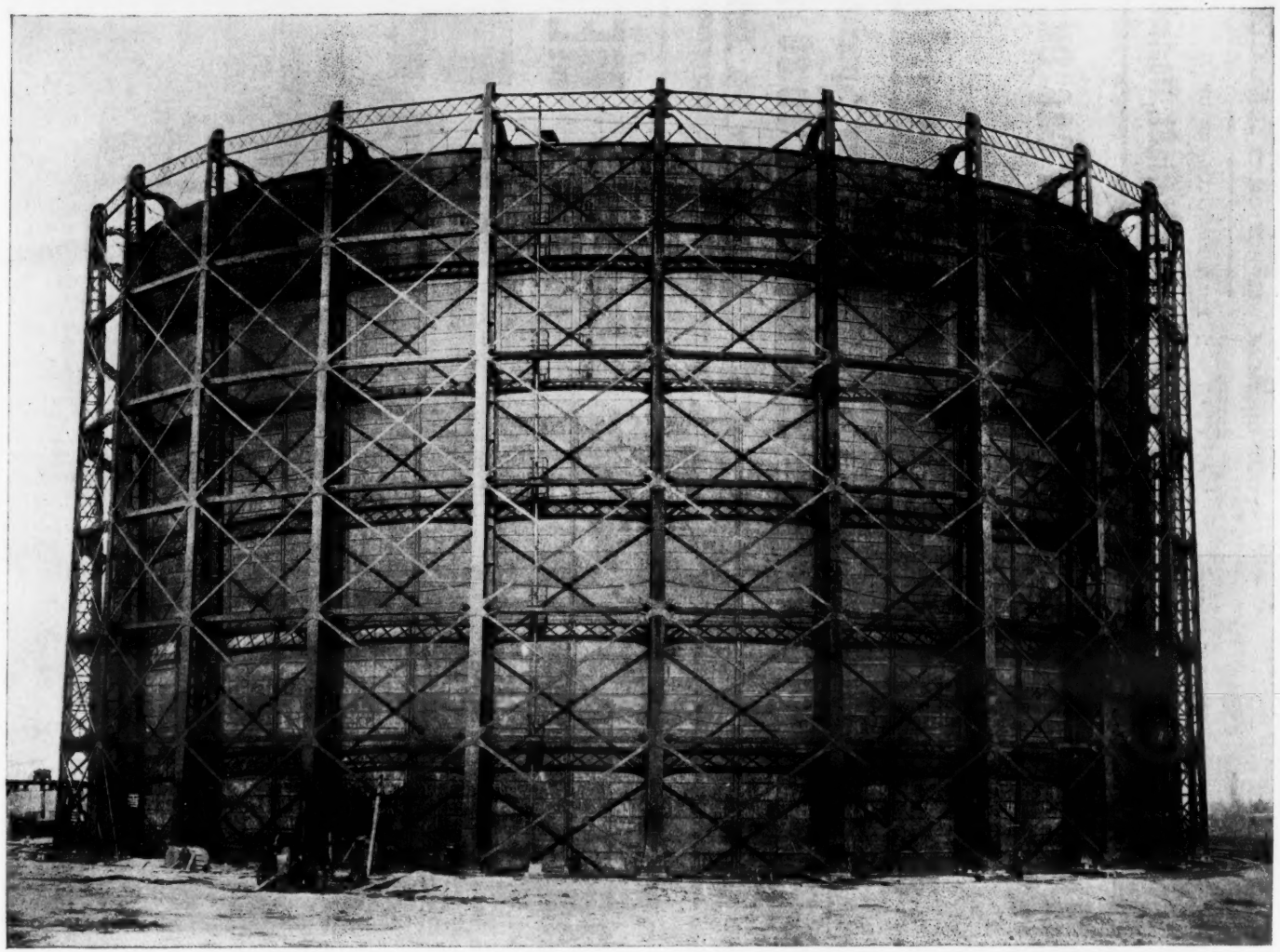

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delegates. The contribution could be separated into two parts—one absolute for the country, and the other additional according to its commerce and population. Dr. Eitner thought it was not necessary to nominate more than six members per country.

After further observations, the discussion was adjourned. The eventual decision will be found recorded below.

Friday, July 28.

The President showed the spectro-photometer of M. Thovert, of which a description is given on p. 359, after which Dr. Eitner said that nine years ago he had constructed an analogous apparatus. It was formed of an ordinary spectroscope; but the slit coincided with the limit of the two sight spaces of a photometer. When the lighting was equal, the limit disappeared. This was able to be effected by a suitable choice of the angle of two parallelipedes which were placed under the screen. The scale was visible at the same time as the spectra; the latter being seen as two rectangles touching one another. One saw at once in one slit of the eye-piece 1-50th of the length of the spectrum, or even 1-200th if necessary. The apparatus was made by Zeiss.

Dr. Strache having read his paper on "An Absolute Unit of Light," of which an abstract translation is given on p. 358, M. Weiss said he thought there was too much diversity in the sensibility of the human eye for a strict solution to be possible; one of the reasons, for example, being the varying fatigue of the eye for each colour. The proposal of Dr. Strache was, however, one for examination. M. Brodhun found it very difficult to agree upon the curve of sensibility of the eye with the wave length, so as to arrive at a practical solution. Much remained to be studied—that of the dark body not being finished. Dr. Strache said there was already progress, as actually everyone measured heterochrome sources by eye. The question was sufficiently important to go on with. Moreover, the distribution of energy in the spectrum of a dark body was now almost completely investigated. The President did not oppose the course indicated by Dr. Strache, but thought one would have to await better results from improvements in the spectro-photometers, as with them differences of shade and the fatigue of the eyes were no longer important. Certain investigations in the region of the spectrum could therefore be made. M. Brodhun thought it would be necessary to consider an analogous curve to that of Lummer, so as to reduce the relative results from different colours to only one of them. The President observed that towards the ends of the spectrum, the sensibility of the eye was rather weak, so that one need not know the curve with exactness. Also, each observer would read the curve of Lummer for himself. Dr. Strache said, in short, that he proposed to study: (1) The comparison of different regions of the spectrum between themselves; (2) the determination of the radiation of dark bodies; and (3) the construction of an apparatus. Dr. Eitner supported Dr. Strache, and thought a Sub-Committee should examine the question. The President said it was a rather special one to be sprung on National Laboratories. Dr. Strache added that, once formed, the Sub-Committee could themselves apply to National Laboratories. This was agreed to.

The question of the re-election of members was next raised by the President; and Dr. Eitner asked whether the Commission or the institutions would have the nomination of them. The President answered that it would be the institutions who would elect them after each session. Dr. Eitner fancied this might interfere with the continuity of their work; but the President thought otherwise, as the members interested would be re-elected. M. Deville remarked that it must be left to the institutions to arrange to be represented by old and new members. Dr. Eitner said he would hesitate to take part in the work of a Sub-Committee if he was not sure of re-election. Dr. Strache supported M. Deville, who said the Commission should be made up only of those active members elected for a single session.

Re-assembling in the afternoon, the President announced the results of the Sub-Committees which had been appointed—the one on "The Comparison of the Vernon-Harcourt, Hefner, and Carcel Standards," and the other on "The Substitution of Calorific Power for Lighting Power." The latter is given on p. 358. The former is as follows:—

The Sub-Committee, consisting of M. Vautier, President, and MM. Brodhun and Laporte, have calculated the modifications brought about in the relationship of the luminous intensities of the three lamps—Carcel, Hefner, and Vernon Harcourt—by the change in the atmospheric conditions of normal working of the Vernon Harcourt lamp, which was indicated in a letter of Mr. Glazebrook, Director of the National Physical Laboratory.

According to the terms of this letter, the normal atmospheric conditions for the working of the Vernon Harcourt lamp are: Height of barometer, 76 cm. of mercury; humidity, 8 litres of water vapour per cubic metre of dry air, instead of the conditions previously given: Height of barometer, 76 cm. of mercury; humidity, 10 litres of water vapour per cubic metre of dry air.

Using the co-efficient of 0·066 per litre of water vapour given by Mr. Paterson, the relative values accepted in 1907 become after this correction:

Carcel = 10·75 Hefner remains Carcel = 10·75 Hefner.

Vernon Harcourt = 10·95 Hefner becomes Vernon Harcourt = 11·10 Hefner.

Vernon Harcourt = 1·020 Carcel becomes Vernon Harcourt = 1·035 Carcel.

And in calculating the table of double entry:

	Carcel.		Hefner.		Vernon Harcourt.
Carcel	1	..	10·75	..	0·965
Hefner	0·0930	..	1	..	0·090
Vernon Harcourt.	1·035	..	11·10	..	1

The decisions of the Committees were unanimously adopted.

Questions of internal administration were next discussed. The President called to mind that there had been agreement as to the increase in the number of delegates, but not as to their number. Herr Drehschmidt asked that he might prepare a scheme of regulations which could be submitted to the institutions of which they were delegates. The President said that this was exactly what they were discussing. Did they think they should state a maximum number of delegates for each country, that this maximum should be six, and that it ought to be the same for all countries? Dr. Eitner thought everyone was agreed to increase the number to six for those countries which had four, and to two or three for those which had one. M. Deville proposed to allow every country to have the same number up to the fixed maximum. It was eventually unanimously decided to adopt the numbers of six and three in place of six and two.

The question of re-election of delegates was then further considered. M. Deville said the institutions could be written to after each session that their delegates had practically resigned, and that they were invited to renominate them or appoint others. Dr. Colman said the duties of a delegate ought to go on from one congress to the next. If he worked, he would naturally be re-elected. M. Deville thought it was necessary to anticipate a revision by the technical institutions of the list of their delegates, and that after, or on the eve of, each session. Dr. Colman thought this revision ought to be after the sessions; and M. Weiss was of the same opinion. There was further discussion on the point; but no decision was arrived at.

Passing on to consider the question of funds, the President asked if an annual credit was necessary, or should they wait for a sum to be repaid. M. Deville was in favour of an annual allowance for current expenses, and in addition each session should have to provide a credit for research work. Dr. Colman said he was authorized by his Institution to promise their quota of the bureau expenses; but as regards other work, he had no authority. The President said it would be necessary to ask the technical institutions if they were agreeable to subsidize the work. Dr. Eitner said it would be necessary to decide this question in principle without having any particular work in view. M. Weiss thought it would be better to draw up beforehand a programme of work. On the President's suggestion, this matter was also left undecided and carried over to another session.

The subject of the admission of members representing electrical groups was then considered. M. Brodhun was in favour of it; but it was necessary to come to an understanding with the electricians. M. Laporte desired that the electricians and the gas engineers should agree on the same unit. In Germany, Dr. Eitner said, the gas engineers always consulted the electricians. The President said that in France, the *gaziers* were present on the Electro-Technic Committee.

The resolution proposed was: "The International Photometric Commission are of opinion that, for questions common to both gas and electrical industries, the electricians be invited to participate in the meetings." M. Deville thought the electricians ought to be invited for the whole session, when common questions would be considered. Dr. Strache said that as in each session the unit of light would be discussed, the electricians would be always invited. The President remarked that the presence of the electricians would be permanent perhaps, but facultative. The resolution was unanimously adopted with the addition suggested by M. Deville.

The next point raised by the President was the number of votes by which a decision could be obtained which might be described as emanating from the Commission. Unanimity could not be expected. He would willingly accept that it should be four-fifths of the members. Dr. Eitner saw no inconvenience from this; but a vote of the majority could not force a country to carry out the decision. The President said it was, however, necessary to decide on the effect of the decisions of the Commission, which might not be unanimous. Dr. Eitner supported the principle of the majority to decide if a scientific question had been sufficiently elucidated. The President put it to the vote; and it was decided that four-fifths should be required to carry the *imprimatur* of the Commission—that is, four-fifths of the votes expressed.

M. Deville raised the question as to the number of electricians to be admitted to the Commission. Dr. Eitner proposed one delegate from each country taking part in the International Commission of Electricians. The President said the International Commission of Electricians could be asked to send the number of delegates they thought fit. It was the Commission authorized by the technical societies that ought to give the invitation. M. Laporte gave the information that the International Electro-Technical Committees met only every four years. There would be too long to wait for the nomination of the electrical delegates. Mr. Butterfield suggested that when common questions arose the technical institutions would be able to decide that a certain number of gas delegates be replaced by electricians. The President thought this proposal would touch the dignity of the Commission, who ought to issue the invitations. The Commission decided that their bureau should invite the National Electro-Technical Committees of the International Commission to delegate one electrician

per country to take part in the discussions on all questions of common interest. The following morning (Saturday, July 29), this decision was modified by the President's suggestion, unanimously adopted, to invite two electricians for countries having six delegates, and one for those which have three delegates.

Saturday, July 29.

The question of the unit of intensity was discussed. Dr. Strache said that he was very glad that America, England, and France had agreed on the same unit; but for the moment it could not be accepted as international. He did not wish that the unit should be chosen under the form of an incandescent electric lamp, because the luminous rays were not alone interesting. He would like the new unit to be in simple relation to the Hefner, which could at the same time be maintained. As a simple proportion, 9/10 is admissible; but it ought to be sanctioned by the Commission. M. Brodhun said it seemed to him that they should first discuss the question of the nomenclature of the unit. The President said this would be difficult if they had not the elements on the other questions. M. Brodhun replied that the thing was simply to discuss this future denomination. Dr. Eitner said they were speaking only of the denomination, because they were satisfied that the new unit would be 1·1 Hefner. For England, nothing is changed; and they hoped it would be the same for France. They could not speak of the new unit as international, for they could not adopt it. The word "international" ought to be reserved for a new unit really adopted by all countries. A sub-committee could be nominated to try for the realization of an objective unit. One of the three names suggested—normal kerze, normal candle, standard candle—might be chosen. M. Brodhun, in the name of the Reichsanstalt and Electrical Committees taking part in the International Commission of Electricians, had to oppose the use of the term international unit. One ought not to diminish the sense of the word "international."

M. Deville inquired whether the height of the flame of the Hefner could not be increased a little, so as to increase its intensity about $\frac{1}{20}$th, in order that the countries which used this standard might realize an intensity near to the unit. M. Brodhun said this would necessitate very long investigation. It would be necessary to re-make all the investigations into the Hefner to see what would be the effect of external conditions. Dr. Eitner said he had been engaged on the increase of the height of the Hefner flame, but this made the lamp a great deal less satisfactory, because the flame became much more changeable. The new standard thus effected would be much more difficult to reproduce than the old Hefner lamp. M. Deville said the Hefner could be used by bringing it a little nearer the photometer. Dr. Eitner replied that it could not be done, because the difference of 11 per cent. was too great. It was impossible for them to change the standard. In commerce, they would be compelled progressively to indicate the two units. Dr. Colman said English gas engineers would be glad of an agreement or an international unit; but they appreciated the point of view of the Austrians and Germans. They were not of opinion that the word "international" should be used—at least, not until it was unanimously decided upon.

In the name of the Institution of which he was delegate, he accepted the dimensions of the new unit. He advocated the name of "standard-candle," which they already had. Dr. Eitner said they could give three names to the unit: Standard-candle, standard-kerze, and standard-bougie. Dr. Colman thought the word "bougie" would lead to misunderstandings. It was not desirable to say "Hefner kerze" (candle), but "Hefner-einheit" (unit). If the Commission requested this change, it would be effected little by little. M. Brodhun said they could not arrive at a decision, because he did not know the opinion of the Reichsanstalt. In Germany, one talked at first of the Hefner light, and it was only after the congress of Geneva, when it was thought the Hefner was going to become international, that one spoke of the Hefner candle. In Germany, one said simply candle, and it would be difficult to make this practice disappear. But it might be considered. Dr. Eitner was of the same opinion as M. Brodhun; but he did not think there was any great confusion due to the word candle. Moreover, outside Germany, one always said Hefner and not Hefner candle.

M. Laporte said one did not always know, when reading a book, whether it was referring to a Hefner candle or a standard candle. It would be very useful to avoid these confusions by simply saying Hefner or Hefner unit. The same applied to English works. Dr. Eitner believed that in literature one said only Hefner candle. This did not lead to confusion. The President read a letter from M. Van Rossum and M. Terneden, who said that the international unit ought to be voted by the Commission; but they did not think it would be practically realized. M. Terneden said in Holland they used the Hefner kerze and the English candle, and they were not confused. M. Weiss said in Switzerland gas engineers and electricians used the word Hefner kerze, and there was no other denomination. M. Böhm said in Italy they had the carcel and the decimal candle (*bougie décimale*) in the gas industry, while the electricians used the Hefner kerze. The President pointed out that Italy had adhered to the international candle. He thought that it was possible to arrive at a resolution giving satisfaction to the countries which had already agreed. This would indicate progress. He thought they should abstain from using the word international, which was something excessive at a time when Austria, Germany, and Switzerland did not accept it. It might perhaps be convenient to call the new unit, decimal. M. Brodhun remarked that they recognized the advantage of a simple ratio between the Hefner and the new candle. As to the word decimal, he did not think that it ought to be used in view of the uncertainty of the ratio existing between a Violle unit and the new unit.

The President said the results of M. Violle had not shown important variations, as was thought. M. Violle had compared his unit to the Hefner, but previously to the tests on the Hefner by the Reichsanstalt—that is to say, when it had not been really well defined. M. Brodhun said he only wished to indicate the difficulties which might arise from the word decimal. The President said that if the new investigations made it possible to use the Violle unit, they would have perhaps to change the co-efficient by $\frac{1}{20}$th. Dr. Strache said they had not to discuss the Violle unit. He preferred the word standard to decimal. The President said the word standard was not a good one for France. He preferred normal. A Sub-Committee would be appointed to consider the following points: (1) To take note of the agreement; (2) to recognize the progress; (3) not to use the word international; (4) to propose another denomination (two or three names); (5) to advise the separation of the words candle and Hefner.

M. Brodhun said they were in agreement on the first four points; but as to the fifth, he was not authorized to decide. It seemed difficult to change the denomination without changing the dimension. Dr. Eitner thought that his Society did not wish to change the word Hefner-kerze. There was no inconvenience in it outside Germany. M. Laporte did not share this view. In many instances there was confusion. The President proposed the Sub-Committee to consist of MM. Brodhun, Eitner, Colman, and Laporte.

In the afternoon, the President read the suggested resolution proposed by the Sub-Committee on the International Unit of Intensity. The resolution, unanimously adopted, is as follows:—

The Sub-Committee, consisting of M. Th. Vautier, President, and of MM. Brodhun, Colman, Eitner, and Laporte, propose that the International Photometric Commission adopt the following resolutions:

The International Photometric Commission take note of the agreement concluded between the National Physical Laboratory of England, the Bureau of Standards of America, and the Laboratoire Central d'Electricité of Paris, to maintain with a common accord a common illuminating unit, such as:

1 decimal candle = 1 English candle = 1 American candle, and that 1 Hefner unit be considered as 0·9 of this common unit.

They record that this agreement, to which the gas and electrical industries of a certain number of countries have adhered, realizes notable progress by reducing the number of units in use from four to two.

They consider that it would be better not to give the name international to a unit which has not been accepted by certain important countries.

They are of opinion that it would be convenient to give to this common unit in the different countries a name such as "standard candle" (*bougie normale*) or "decimal candle" (*bougie décimale*).

They express the wish that each of these units may not be described under the simple name of "bougie," "kerze," or "candle," but under the full name, in order to avoid confusion.

The President then read propositions made by M. Blondel in a recent number of the "Illuminating Engineer." These are reproduced on p. 360. Upon them, M. Brodhun said there was a mistake, as it was not with the decimal candle that the different standard lamps had been compared, but with the Carcel lamp. Further, it would be necessary in Germany to change the denominations which were already usual; and the Germans were tied by the decisions actually adopted by the electricians and gas engineers. In the place of "lux," one proposed "lumen per cm.^{2}," and the "lux" was already generally used. One could also say "millilumen," but it was too long an expression. M. Laporte said it was better not to give a name to a unit of lighting in order to keep symmetrical with the radiation, but the term "decalux" might be introduced. M. Brodhun said the International Commission indicated by J_0 the average spherical intensity, while there was J_s. Further, why write either $\frac{dF}{dS}$ or $\frac{F}{S}$? Dr. Eitner associated himself with M. Brodhun. There was an advantage in passing to the C.G.S. system; but was this advantage real, if a new unit was introduced? It was best to pause before coming to a decision.

The President proposed to take note of M. Blondel's proposition. A Sub-Committee would make a report on this question for the next session. It could take the opinion of the technical institutions. If the proposition was adopted, each would change his system a little; but that would be less important than the advantage of having established unification. Dr. Eitner said the replacing of the square metre by the square centimetre was only a question of calculation, but it was necessary to keep the "lux" which had entered into practice. Dr. Strache supported the proposal of the President because it was requisite to know the opinion of electricians. Dr. Colman also thought there should be a Sub-Committee. The President proposed a Sub-Committee of MM. Brodhun, Laporte, Kusminsky, Paterson, and Hyde. This was unanimously adopted. The Commission took note of the propositions made by M. Blondel in the name of the Illuminating Engineering Society.

The President said it remained to elect a Sub-Committee on

the proposal of Dr. Strache for the investigation of an "Absolute Unit of Light." Specialists were necessary. He proposed MM. Brodhun, Laporte, and Strache, and other delegates as may be chosen, or who desired to take part. Dr. Strache said, in addition to those named, they might have the assistance of MM. Kusminsky and Butterfield.

Dr. Eitner reported that M. Weiss would like a Sub-Committee to be formed to investigate the variations of the Hefner at altitudes. He could then prepare a programme and ask for a fund. It would be well to have colleagues who could easily reach Zürich, for example, MM. Ott and Eitner. Mr. Butterfield said he could prepare a programme in writing but could not be present. M. Deville said that M. Weiss could prepare the programme and give the date. The members who desired would be able to come. Dr. Eitner said it would be enough officially to authorize M. Weiss to make the investigations and to have collaborators for the purpose.

MM. Strache, Brodhun, Laporte, Kusminsky, Butterfield, and Hyde were appointed to this Sub-Committee.

The President then proposed that the next gathering should be in three, and not four, years. It was understood that, in case of urgency, the Commission could be called before then. It was agreed to meet in three years. The President then said: "I am glad to see that harmony has reigned among us, and I thank the members who have been good enough to come and contribute to our work. It may be hoped that this will be even better in the fourth session."

Dr. Eitner added: "Before we separate, I beg you to allow me to call your attention to the work done. We have succeeded so well, thanks to the goodwill of all, and to the labour of the President. I thank him in the name of all."

This concluded the third session of the International Photometric Commission.

THE PAPERS, &c., SUBMITTED AT THE PHOTOMETRIC COMMISSION MEETING.

In last week's number of the "Journal," pp. 288-90, there was reproduced the text of the paper read at the International Photometrical Congress, at Zürich, by Mr. Butterfield—entitled, "Corrections for the Effects of Atmospheric Conditions on Photometric Flame Standards"—the joint production of himself, Dr. Haldane, and Mr. A. P. Trotter. This was the most extended written communication made to the meeting; but others were also submitted, and are here reproduced, either in full or in abstract.

METHODS OF PHOTOMETRIC MEASUREMENT.

By Professor Dr. Eitner, of Karlsruhe.

Since the labours of the Commission with regard to the question of photometric units have reached a certain conclusion by definitely establishing the ratio of their light intensity, the next task of the Commission appears to be to come to an agreement as to the methods of photometric measurement. A suggestion by Privy Councillor Bunte, to request the delegates to report upon the methods usually employed in the various countries, in order to obtain a basis for possible standards, was approved of by the President; and I therefore undertook to report upon the methods used by us for the measurement of light.

In my opinion, the Commission has to consider—

I.—The measurement of the intensity of light.

II.—The measurement of illumination.

I.—The Intensity of Light.

The intensity of light is always measured by comparison of the illumination or brightness produced by the source of light on a white diffusely reflecting surface, with the illumination or brightness produced by the unit of light or by an intermediate source of light of known strength on a surface of identical properties. The illumination of the two surfaces the brightness of which is to be compared is equalized by reducing the amount of light sent out by the stronger source; and the proportion of the light-intensities is calculated by the proportionate diminution of the stronger source of light.

The methods of diminishing the intensity of light for the measurements which have to be considered, are—

(1) Alteration of distance (law of distances).
(2) Alteration of angle of incidence (cos i — law).
(3) Diaphragm (rotating sector discs and the like).
(4) Optical diminution (smoke glasses, polarization, &c.).

The alteration of distance is the method most frequently employed, and exclusively with bench photometers, which are the most important type from the point of view of an agreement upon methods of measurement. Observations can be made according to two principles.

(*a*) The sources of light to be compared are fixed at the two ends of the bench at a constant distance apart, and the photometer screen is shifted between them till its two sides appear to be equally bright. This process affords the advantage that the sources of light need not be moved, and so can be kept free from vibration. There is, however, the disadvantage that the observations must be made with varying and frequently unfavourable illumination intensities on the screen. Values below 10 candles and above 80 candles become consequently insusceptible of measurement unless for these light-intensities benches of special and suitable length are used.

(*b*) The source of light to be measured is fixed at one end of the photometer-bench, and the standard source of light is rigidly fixed at a constant distance from the screen. The distance is so arranged that an illumination is produced on the screen at which the normal human eye is most sensitive for differences in brightness (about 10 lux). With the photometers of the Chemico-Technical Institute of the Technical High School at Karlsruhe, the illumination produced by the standard source of light is exactly 10 lux (distance of light unit from screen $\frac{1}{\sqrt{10}}$ m. = 31·6 cm.). In this case, when adjusting the screen for equal brightness on both sides, one has simply to multiply by 10 the square of the distance (measured in metres) of the source of light which is being tested from the photometer screen, in order to find its light-intensity.

This method makes it possible to measure any intensity of light, however great, with the same most favourable illumination of the screen. The disadvantage is that using the standard light direct for comparison, the Hefner lamp has to be shifted together with the screen and flickers. For very exact observations, it is therefore necessary to replace the Hefner lamp by an electric intermediate source of light which, if worked below normal power, produces 10 lux. The lamp must be supplied with an absolutely constant electric current of definite voltage, if possible from an accumulator battery exclusively used for this purpose. The current is adjusted by a resistance with small temperature constant, and can be measured to an accuracy of 0·1 per cent. An alteration of the current by 0·1 per cent. corresponds to an alteration of light-intensity by 0·4 to 0·5 per cent. with carbon filament lamps. The ratio is less favourable with metal filament lamps. The measurement of tension at terminals, instead of current, does not exclude grave errors, and can therefore not be recommended.

The measurement of large light-intensities requires, with this method, very long photometer-rooms (measuring in length for 1000 candles about 11 metres, with a length of photometer-room of 15 metres), and arrangements for moving the photometer-table along its axis, in order to obtain the proper distance from the source of light to be measured. The method yields, however, the most accurate results. If the Hefner lamp is first put at the end of the photometer instead of the source of light to be measured, and is compared with the intermediate standard, and subsequently, after removal of the Hefner lamp, the light is measured, a substitution process is obtained which eliminates all errors of the photoped, and therefore permits the most certain measurements. This method is generally used at the Chemico-Technical Institute of the Technical High School at Karlsruhe, and at the Experimental Station of the German Association of Gas Engineers.

Photopeds.

For exact measurements, only those photopeds are employed where the fields of vision are in direct touch, and not separated by a dark line. The photopeds of Lummer and Brodhun and of Martens comply with this requirement. If the colour of light is quite equal, the "photometer for equality and contrast" (Lummer and Brodhun) is employed. For the measurement of light of different colours, intermediate standards with interposed coloured glasses are used, which mitigate the colour contrast. The observations are here taken by the substitution method. It is important in the case of all photometers that the fields of vision to be compared should have a minimum apparent size of 4 square centimetres. In exceptional cases, the flicker photometer is used for the comparison of sources of light strongly differing in colour.

Distribution of Light Intensity in Space.

(*a*) *Mean Horizontal Light-Intensity.*—The simple measurement of the light-intensity in one direction is in most cases insufficient for the determination of the efficiency of a lamp. For lamps having an axis of symmetry, and showing the highest intensity in the vertical plane through its centre, the mean light-intensity is often determined in this plane, and is called the "mean horizontal light-intensity." It is assumed that the axis of symmetry is vertical (as in upright incandescent gas-burners). For the measurement of mean horizontal values, the axis of symmetry is put in vertical position, and observations are taken in ten directions of the horizontal plane, differing from each other by 36°, by turning the burner 36° after each observation. The average of the ten measurements is the mean horizontal value. In the case of electric incandescent lamps, the axis of symmetry can also be put in a horizontal position or parallel with the axis of the photometer bench. By mirrors which rotate around the lamp in a vertical plane, the light emitted by the lamp at right angles to the axis of symmetry can be reflected on the photometer screen; taking care that the direct light is cut out. Allowing for the coefficient of reflection of the mirrors, the mean horizontal light-intensity of the lamp can be obtained direct by this method.

(*b*) *Vertical Distribution of Light-Intensity.*—For the valuation of lamps, the distribution of light in space in the vertical plane

is very important. This is determined by measuring the light-intensities in a plane through the axis of symmetry at various angles by means of angle photometers or mirrors. The results are plotted in the known manner in polar curves. If the lamp has different values in different planes of symmetry at the same angle of radiation, the mean value for each angle must be determined in the same manner as the mean value for the horizontal plane. These mean values are used to plot the distribution curves.

(*c*) *Mean Light-Intensity in Space.*—For the measurement of the total light effect of a lamp, the mean space light-intensity is determined. This can be calculated from the values obtained under different angles of radiation, by multiplying these values by the magnitude of the corresponding spacial angles, and dividing the sum of these products by the total spacial angle. If the values at the angles $\alpha_1, \alpha_2, \alpha_3 \ldots$ measured against the axis of symmetry which is assumed to be vertical, and whose direction below corresponds to the angle 0°, and if, further, the angle distances of the different directions of measurement are each equal to the nth part of the total plane angle ($= \frac{2\pi}{n}$), then the mean spherical light-intensity is represented by the recognized formula—

$$J_s = \frac{\pi}{n} \Sigma J_\alpha \times \sin \alpha.$$

In similar manner, the mean hemispherical light-intensity for the lower hemisphere J_{su}, and for the upper hemisphere J_{so}, can be calculated by adding up products from 0° to 90° and from 90° to 180° respectively, and dividing by half the spacial angle.

The lower hemispherical value would therefore be—

$$J_{su} = \frac{2\pi}{n} \times \sum_{\alpha=0}^{\alpha=90} J_\alpha \times \sin \alpha$$

and the upper hemispherical value

$$J_{su} = \frac{2\pi}{n} \times \sum_{\alpha=90}^{\alpha=180} J_\alpha \times \sin \alpha.$$

This method of calculation of the spherical light-intensity from the data of observation at various angles can be employed with all kinds of lamps, and is to be recommended. For electric lamps, integrating instruments may also be used—for instance, the spherical photometer of Ulbricht. But their constants have to be redetermined from time to time.

II.—Illumination.

The illumination of a surface is measured by placing in the position to be examined a white diffusely reflecting surface, and comparing its surface brightness with that of a similar surface which is illuminated by the standard lamp or another source of light of known intensity, and the illumination intensity of which can be measurably altered. When both surfaces appear to be equally bright, the illumination is equal, and the illumination intensity produced by the standard can be read off. For these measurements are employed the street photometers of Weber, Krüss, and Brodhun, the illumination meter of Martens, and the universal photometer of Bechstein. The accuracy of these instruments must be checked by comparison with known illumination intensities.

The unit of illumination is one lux—*i.e.*, the illumination produced by the unit of light, the Hefner candle, when radiating upon a surface at right angles from a distance of a metre. In order to obtain the mean horizontal illumination of a room (say) at table height, the plan of the room is divided into sections of a form and size which allows a calculation of their area, and the illumination of which will show small differences only at various points when measured, so that the value obtained for the centre of each section can be taken as its average without appreciable error. The area of each section is then multiplied by the illumination value found for it, and the sum of all these products is divided by the total area of the room. The figure obtained is the mean horizontal illumination of the room for the plane of a definite height. When measuring the illumination of streets and open places, it is usual to plot the results on the plan, and connect points of equal illumination by curves.

A SUGGESTION IN REGARD TO INVESTIGATIONS ON AN ABSOLUTE UNIT OF LIGHT.

By Dr. Hugo Strache, Professor at Vienna.

The distribution of energy in the spectrum of an absolutely black body is known. The distribution of light in this spectrum can be determined with ordinary photometers. The proportion of the energy in a ray of particular wave-length to which the eye is sensitive as light can thus be ascertained. Lummer has determined on these lines the curve showing the sensitiveness to light of the eye as a function of the wave-length. A means is thus afforded of obtaining an objective photometric method, and of finding a basis for a unit of light expressible in terms of absolute measures.

If the rays of light from any source are allowed to fall on a radiation measurer, the red rays have a far more powerful action than the blue. The maximum effect on the eye, however, occurs in the green. Consequently, the action or effect of light cannot be determined by a simple radiation measurement. If, however, only that portion of the red radiation which corresponds with the effect on the eye is allowed to fall on the photometer, by screening off the corresponding portion of this radiation, and seeing how this corresponds for any wave-length to the relation established by Lummer's curve, a value is obtained for the radiation in the energy measured which is proportional to the effect of light on the eye.

It is only necessary, in order to make such a measurement, to resolve the light into a spectrum, and by the interposition of a diaphragm to reduce the red waves and the blue waves so that they correspond with Lummer's curve, collect the rays together again by means of a cylindrical lens, and allow them to fall on an apparatus for measuring radiation. The diaphragm should therefore be cut so that it corresponds with Lummer's curve.

In this manner, the illuminating intensity is expressed in terms of absolute measures, such as calories. All the difficulties attendant on the photometry of lights of different colours are avoided by this method. A comparison of the effect of different colours on the eye must, however, have been once for all carried out; and this has already been done by Lummer. This difficulty occurs only in the first instance when the curve of the sensitiveness to light of the eye is being established. It will, however, differ for different eyes. But the mean from a great number of observations by different people can be taken; and finally a conclusive international agreement could be reached as to the form of this curve, representing expressly the sensitiveness to light of an average eye. Once such a curve has been agreed upon, photometry would be possible in which the eye would no longer be employed as a means of observation. The illuminating intensity being, with such a photometer, expressed in terms of absolute measures, it follows that the unit of light can be also similarly expressed, and that flame standards with their disabilities will no longer be required, but the unit will instead be expressed on the C.G.S. system.

Having regard to the importance of this question, the author proposes to move the appointment of a Sub-Committee to report to the International Photometric Commission whether they regard the attainment of this end in the manner indicated as practicable, and what measures should be adopted to achieve a definite solution of this question.

NOTE ON A METHOD OF FACILITATING THE SETTING OF THE HEIGHT OF THE FLAME IN THE HEFNER LAMP.

By Dr. Hugo Strache, Professor at Vienna.

It is well known that it is of great importance, when using the Hefner lamp, to set the height of the flame very exactly, and, moreover, the proper setting of the flame in exact observations must be constantly controlled by a second observer. In order to avoid this evil, a thermo-couple connected with a milli-voltmeter, and consisting of two superposed crossed wires, is employed at a height of 5 mm. above the tip of the flame—that is, 45 mm. above the base of the flame. The height of the flame is set in the first instance by exact observations, and the deflection on the milli-voltmeter is read. In subsequent observations, the indication of the milli-voltmeter is referred to in order to obtain a more rapid and a more exact reading than that of the direct reading of the height of the flame. When the tip of the flame is blown even very little to one side, the deviation of the milli-voltmeter becomes considerably less. Photometric measurements have, therefore, to be made at the moment when the deviation is at the maximum. If the thermocouple is connected with a mirror galvanometer, the maximum deviation can be observed by an optical signal. If the thermo-element is connected with a relay which closes a circuit having a strong current, an acoustic signal can be arranged for the correct setting of the Hefner lamp. Only one observer will then be necessary.

FLAME TEMPERATURE AND INCANDESCENT LIGHTING POWER.

By Dr. Hugo Strache, of Vienna.

M. Sainte-Claire Deville has shown by a very interesting and wide research on maximum illuminating power that, by the use of different mixtures of gas in an incandescent burner, its illuminating power is nearly in proportion to the heat of the combustion of the gas. It is clear from these investigations that the variations are nearly 15 per cent., if gas is used containing a great deal of hydrogen and having a low calorific power. The production of light is better with these poor gases.

Dr. Mayer has made similar investigations with ordinary burners having no artificial incoming air. The same result was arrived at —namely, that mixtures rich in hydrogen produce a better effect per calorie used, but that the variations are so slight that in practice it can only be said that there is a relationship between illuminating and calorific power. In his researches, the variations are nearly the same as in those of M. Sainte-Claire Deville.

It may now be shown what are the results obtained by adding carbonic acid to the gas instead of hydrogen or carbonic oxide, because this undoubtedly lowers the temperature of the flame. The experiments were limited to the use of burners without artificial incoming air, as this corresponds to the conditions under which the gas is used in practice. The best method would have been to choose for each gaseous mixture the suitable burner and mantle giving the best results; but then really comparable values would not have been obtained. It was, therefore, necessary to carry out the series of tests with the same burner and the same

mantle, and in each case to arrive at the best return by means of an adjustable opening. The gas pressure was kept constant. It was always 30 mm. On the contrary, the amount of gas and of air were regulated so that the maximum efficiency might be attained. This adjusting was freshly done for each test. Both vertical and inverted incandescent burners were used.

The investigations made in common by Dr. Fritz Kropf and myself gave the results set forth in the tables below. They show that the presence of carbonic acid in the gas has a very important effect on the amount of heat given out in the incandescent burner per candle and per hour, to such an extent that in many cases double the amount of heat had to be used as compared with gas free from carbonic acid. So that, if the investigations of M. Sainte-Claire Deville and Dr. Mayer have shown that the yield becomes better if the calorific power of the gas is lowered by the addition of hydrogen or carbonic oxide, the present investigations indicate that the yield becomes a great deal less favourable if the calorific power of the gas is reduced by the addition of carbonic acid. The two facts are explained by the changing of the temperature which is produced by the changing of the volume of the flame. Hydrogen diminishes the volume of the flame, and thereby raises the temperature. Carbonic acid, on the other hand, diminishes the volume of the flame and considerably reduces its temperature. There is thus put in evidence the great influence of the temperature of the flame on the illuminating power of the gas in incandescent burners; and it can no longer be said that there is a proportion between calorific power and illuminating power, if it is a question of gas of very different flame temperature.

In conclusion, tests were made with gas having its flame temperature lowered by the addition of carbonic acid, but the calorific power of which had been restored to the same value by carburetting. Both after being carburetted with benzene, and with acetylene, the effect of the carbonic acid showed itself by reducing the efficiency.

INVESTIGATIONS ON THE EFFECT OF CARBONIC ACID ON THE EFFICIENCY OF INCANDESCENT GAS BURNERS.

By Dr. Hugo Strache and Dr. Fritz Kropf.

Coal gas from the Vienna municipal works at Simmering was used. This gas contained carburetted water gas. Its gross heat of combustion varied between 4800 and 5300 calories per cubic metre. So as to have gas of constant composition for each series of tests, it was collected in a special gasholder, and mixed with varying quantities of carbonic acid. In order to have a gas free from carbonic acid, it was led through a mixture of quicklime and caustic soda. Otherwise, the precautions were as indicated above.

Table I.

CO_2.	Consumption, Litres at 0° and 760 mm.	Gross Heating Power. Calories per M^3.	Horizontal Lighting Power. Hefners.	Gas Consumption per Hefner-hour.	Heat Given off per Hefner-hour.
0·0	123	5335	114	1·08	5·78 Cal.
3·8	130	5140	119	1·11	5·71
11·2	145	4760	91·6	1·58	7·46
21·0	175	4255	75·4	2·32	9·85

Table II.—*Small Vertical Burner.*

0·0	73·6	4844	64·0	1·13	5·46
2·9	79·0	4740	62·9	1·17	5·55
7·5	84·0	4522	59·1	1·42	6·42
11·0	92·4	4356	60·5	1·53	6·66
16·6	87·5	4090	46·5	1·88	7·20
25·8	98·5	3670	38·9	2·52	9·25
33·4	128	3300	31·6	4·05	13·37

Table III.—*Inverted Burner.*

0·0	74·5	4820	77·9	0·96	4·62
3·0	77·4	4680	78·5	0·98	4·58
10·8	70·0	4315	60·3	1·17	5·05
14·2	69·0	4155	49·0	1·41	5·87
17·8	79·9	3986	52·4	1·53	6·11
24·3	85·5	3683	44·9	1·91	6·85
28·2	88·2	3520	35·3	2·50	8·80

Table IV.—*Small Vertical Burner—Gas Carburetted with Benzene.*

6·0	75	4810	54	..	6·68
10·0	84	4940	54	..	7·69
15·6	81	4600	46	..	8·10

Table V.—*Small Vertical Burner—Gas Carburetted with Acetylene.*

3·5	72	4830	63	..	5·51
9·4	72	4860	60	..	5·82
12·0	80	4830	56	..	6·90
18·7	81	4800	55	..	7·07

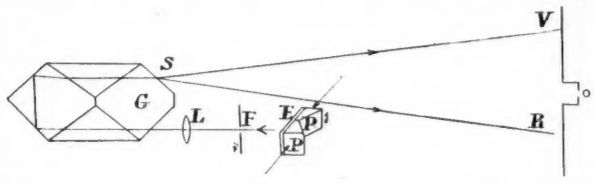
The calorific power was ascertained by means of the Jünkers calorimeter. The average illuminating intensity was ascertained by the Lummer-Brodhun photometer.

A TECHNICAL SPECTRAL PHOTOMETER.

By J. Thovert.

The comparison of the brightness or relative intensity of sources of light in the different colours of the spectrum is of fundamental importance. In technical laboratories, spectral photometric measurements are still but little used. This is due to the spectral photometer being, generally speaking, complicated, costly, and troublesome to handle. The apparatus about to be described was constructed in order to provide the technical man with an instrument almost as simple in character as the ordinary photometer, and manipulated in the same way on the photometer bench, with the exception that the observations have to be repeated for the different colours of the spectrum.

The construction of this apparatus depends on the following facts: The eye looking at the spectrum produced by an apparatus for decomposing the light, sees the whole field of the instrument in the colour in which the rays reach the pupil. If this is a photometric field of vision—*i.e.*, if the sum of the adjacent zones maintains different illuminations—the brightness will be comparable in the same colours, and after changing the position of the eye in the spectrum, the different colours can be observed. This result is obtained in the author's apparatus by the arrangement shown diagrammatically in the accompanying sketch. The transparent photometer screen E receives through the totally



reflecting prisms P P^1 the different illumination of the sources of light which are to be compared, and which are set up at the sides. There is placed on that side of the screen a horizontal slot F, an objective L, and a decomposing lens G, formed of a pentahedric prism, which serves to give the ray of light its original direction, and consequently avoids obstruction. The arrangement is such that the image of the slot F, owing to the passage through the prism, is seen dispersed over the whole height V R. At "o" there is a cap with a small opening, against which the eye is placed, and the field will be seen in one colour in any colour varying from red to violet, according as the position of the cap is shifted between R and V. The field is observed as two adjacent zones, of which the brightness is equal by shifting the instrument between the two sources of light under comparison as in ordinary photometers. The eye-piece can be provided with a glass adapted to the observer's sight; for the rest the field of vision appears, owing to the greater distance at a somewhat small but sufficient angle for the observer.

The maximum illumination is obtained when the whole opening at "o" is used by the pupil. In a model which was exhibited, a rectangular slot 3 mm. by 2 mm. has been used as the opening for the eye, and admits of a very satisfactory utilization of the pupil. The width of the slot in F depends on the dimensions and arrangements of the optical parts employed. The observation of the spectrum is the more exact the wider is the distance between R and V. The eye-piece, in consequence of the law of prismatic decomposition, will obtain from a more or less extended field of radiation, rays of a particular colour which can be indicated according to the wave-length, thereby admitting of direct readings being made. In consequence of the great extent of the blue radiation, and the small brightness of sources of light at the ends of the spectrum, the observation at wave-lengths of less than 0·50 μ becomes difficult.

In order to facilitate observations, a second slit has been made at F, three times wider than the first. This can be shifted by a rack. At O, the ordinary eye-piece is replaced by a small telescope giving slight enlargement which shows at its eye-piece the part of the spectrum bounded by a rectangular opening 9 mm. by 6 mm. Thus the observations can be extended as far as is required. In practice, spectral photometric measurements may be regarded as satisfactory if they are made at equal intervals of time in wave-lengths ranging from 0·48 μ to 0·68 μ. The two observations at 0·48 μ and 0·5 μ are obtained by using a sighting piece of greater brightness, in place of the ordinary diaphragm. Obviously, smaller instruments can be constructed on the same principle for less exhaustive observations. A half-size model would probably suffice for technical purposes, and would be lighter and handier than the pattern hitherto made.

The ratio of the sizes would be reduced by using a simple sighting piece in such a manner that the spectrum is decomposed into three principal zones—viz., red, green, and blue. There would thus be obtained a three-coloured spectrum, which can be applied to any photometer. This simplified decomposition into the colours can only be used on sources of light with a continuous spectrum, and is not sufficient for the observation of such lights as those of flame arc or mercury vapour lamps.

PHOTOMETRIC DIMENSIONS AND UNITS.

The question of photometric dimensions and units has been discussed by physicists at different times. It was the principal topic of a somewhat important discussion at the Congress of

Electricians in Geneva in the year 1896. At that time, as a result of a report of M. Blondel, the Chief Engineer of Bridges and Roadways, a system was worked out having as its basis the bougie-décimale, the metre, and the second. The bougie-décimale was then supposed to be represented with sufficient exactness by the Hefner unit. Since that time, different changes have taken place, among which stands foremost the agreement between the National Laboratories of the United States, France, and England, on the use of a so-called international candle common to the three countries, which, by a happy coincidence, has almost the same value as the bougie-décimale. [It is well known that the bougie-décimale, or Violle candle, is the twentieth part of the platinum unit as defined by M. Violle, and that it was adopted in 1889 by an International Congress of Electricians at Paris as a photometric unit.]

The comparison of the Hefner unit and the Vernon-Harcourt candle with the bougie-décimale was, on the other hand, the matter of very exact measurements by the different National Laboratories. The results of these measurements were adopted by the International Photometric Commission at its session in 1907. These measurements have shown that the Hefner unit is equal to 0·90 of the international candle; so that all measurements which have been made in Germany with the Hefner unit can easily be converted into international units. It appears to the experts of the different countries that the time has now arrived to bring the international system and the photometric dimensions again into unison. This matter had been taken up in the year 1910 in the United States by the Illuminating Engineering Society, under the Presidency of Dr. Alex. C. Humphreys. A Special Sub-Committee for Photometric Units, consisting of Mr. Sharp (President), M. Blondel, Messrs. Kenelly, Nichols, and Rosa, have worked out a series of definitions which are given in the table attached to the report of the Illuminating Engineering Society in November, 1910. [For further particulars as to the report here referred to, see "JOURNAL," Dec. 27, 1910, p. 931.]

These definitions deviate very little from those which had been formerly adopted at Vienna. The centimetre has been preferred to the metre as a unit of length in order to make the system more universally international in character, as the Anglo-Saxon countries have not yet adopted the metric system but only the c.g.s. system. On the other hand, the international candle has been adopted as the unit. The definition of specific radiation which M. Blondel had brought forward at Geneva, but which was not adopted there, has been reinstated. Practice has shown that this specific radiation is quite usable. Finally the introduction of the centimetre as the unit of length has led to the lux, or candle-metre, giving place to the lumen per square centimetre, as a unit of illumination. This unit has the advantage that it carries its own definition with it.

A NOTE ON ILLUMINATING ENGINEERING NOMENCLATURE.

By Professor A. BLONDEL, of Paris.

[From the "Illuminating Engineer," May, 1911.]

The remarks on the above subject of a correspondent in a recent number of the "Illuminating Engineer" (March, 1911, p. 176) lead me to make a few comments on illuminating engineering nomenclature. I beg to protest against the proposed introduction of a so-called "secondary unit" of intrinsic brilliancy, and for several reasons.

(A) The unit is quite useless since the Sub-Committee on Units have already defined "intrinsic radiation" (as I had previously done at the International Electrical Congress at Geneva in 1896) as the quotient of the luminous flux emitted by a surface by the radiating area of the surface. It is easy to see that when this is applied to a diffusing surface of albedo unity the intrinsic radiation is exactly equivalent to the illumination (*éclairement*) expressed in lumens per square centimetre. For example, an ideally white surface absorbing absolutely no light, placed at a distance of 1 metre from, and facing, a source of light yielding one candle, receives 1 lumen per square metre, or one ten-thousandth of a lumen per square centimetre. This last figure, therefore, is also a measure of its intrinsic radiation. If one presumes that the diffusion follows the law of Lambert, the intrinsic brilliancy presented to the eye, at an angle β to the normal, will be—

$$\frac{1}{10{,}000} \times \frac{\cos\beta}{\pi} \text{ candles per sq. cm.}$$

If the albedo is less than unity, if it is equal to $1 - a$ let us say, a being the coefficient of absorption, the intrinsic brilliancy becomes simply—

$$\frac{1 - a}{10{,}000} \cdot \frac{\cos\beta}{\pi} \text{ candles per sq. cm.}$$

If, on the other hand, the surface does not follow the Lambert law, but some complicated function of the angle of emission of the form $f(\beta)$, the intrinsic brilliancy finally becomes—

$$\frac{(1 - a) \cdot f(\beta)}{10{,}000 \cdot \pi} \text{ candles per sq. cm.}$$

All this is quite clear and serves both to show the utility of the physical quantity "intrinsic radiation," and at the same time to demonstrate the futility of introducing a secondary unit.

(B) The secondary unit proposed (or "surface brightness"), also presents the fundamental defect of being based purely and simply on two suppositions—namely, that the albedo is unity, and that the surface follows the Lambert law. In the previous propositions I have not made any assumption of this kind, and the last formula is completely general and applies whatever the nature of the surface.

(C) Moreover, in my opinion, there is no special scientific desirability to distinguish between light emitted by a self-luminous surface and light radiated by a diffusing illuminated surface. On the contrary, it is preferable to treat both alike as sources of light.

(D) The word "surface brightness," has no special meaning attached to it, and does not satisfy any new need. The "intrinsic radiation," on the other hand, does correspond with an actual practical want—namely, the desirability of expressing the total flux of light emitted by a luminous surface which does not comply with the law of Lambert. In general, one measures intrinsic brilliancy in a direction perpendicular to the surface; but this does not suffice to define completely the emissive power of a source. The intrinsic radiation, on the other hand, does enable us to express the total luminous efficiency.

I hope that these remarks will serve to show that the propositions of the Sub-Committee are the result of well-founded deliberations; and, without pretending that they are above criticism, I yet do not consider that they require modifications on the lines suggested by "An Engineering Correspondent."

There are, however, a certain number of accessory photometric quantities which it would be desirable to add to the existing list, with a view to facilitating the comparison between various sources of light. Some such quantities are summarized in the accompanying table. These various symbols need not be included in an official list at present, and may be taken into consideration at a later stage. They should, however, commend themselves to those interested in the technicalities of the subject. It may also be suggested that their tentative use would help to promote a much needed international uniformity in publications on illuminating engineering, and would be of value in supplying precise definitions of the physical quantities on which this subject is based.

Physical and Practical Characteristics of Sources of Light.

J_Φ	=	MEAN SPHERICAL LUMINOUS INTENSITY, expressed in international candles.*
J_r	=	MEAN HORIZONTAL LUMINOUS INTENSITY, expressed in international candles.
e_{max}	=	INTRINSIC BRILLIANCY (*Eclat Intrinsèque*) measured in the direction of maximum intensity and expressed in international candles per sq. cm.
P	=	POWER CONSUMED by a source,† expressed in watts (a portion of which is dissipated by radiation, and the remainder by conduction and convection).
$\frac{P}{J_\Phi}$	=	POWER CONSUMED PER CANDLE (or specific consumption of power), expressed in watts per international spherical candle.
$R = \int_0^\infty R\lambda d\lambda =$		TOTAL POWER RADIATED by a source, expressed in watts. (R is the power emitted by a source in the form of radiation of wave-length comprised between 0 and 8).
$R_e = \int_{\lambda = 0{\cdot}4\mu}^{\lambda = 0{\cdot}8\mu} R\lambda . d\lambda . =$		AVAILABLE USEFUL POWER for lighting purposes, expressed in watts (radiation comprised between the limits of wave-length $0{\cdot}4\mu$ and $0{\cdot}8\mu$).
$\frac{R_e}{R}$	=	RATIO BETWEEN THE USEFUL POWER AVAILABLE FOR LIGHTING PURPOSES, and the TOTAL POWER RADIATED (or radiant efficiency).
$\frac{R_e}{P}$	=	RATIO of the USEFUL POWER AVAILABLE for lighting purposes and the TOTAL POWER CONSUMED by a source.
$\frac{R_e}{J_\Phi}$	=	MECHANICAL EQUIVALENT OF LIGHT, expressed in watts per international candle.
Q	=	TOTAL HEAT DISSIPATED PER HOUR, expressed in gramme-calories.
$\frac{Q}{J_\Phi}$	=	TOTAL HEAT DISSIPATED PER HOUR, PER CANDLE, expressed in gramme-calories per candle.

(*) The symbol is furnished with a horizontal projecting bar to avoid all confusion; either with a zero or with an *s*.

(†) This power or energy consumed per second by the source of light can be calculated, for flame sources, by multiplying together the quantity of combustible burned per second by the calorific heat and the energy equivalent of the calorie.

MODERN DIESEL OIL-ENGINES.

In view of the increased attention now being given by gas managers to the above-named engines—from the fact that, as shown by the paper published in the "JOURNAL" for the 11th ult. (p. 106), they will be the means of utilizing some of the residual products of gas manufacture—it may be of interest to reproduce portions of a paper giving particulars of these engines, submitted by Mr. F. SCHUBELER, of London, at the Institution of Mechanical Engineers meeting held in Zürich a fortnight since.

The author began by reminding his audience that it was the original intention of the inventor of the Diesel engine to burn coal direct in the working cylinder. This, however, proved to be impossible, as the unburnt residues could not be removed. Consequently, only oils, and these of composite properties, would be used as fuel. He then went on to say that the propositions made by different designers for dealing with liquid fuel varied principally in the arrangement of the air-pump and the construction of the fuel-valve. For instance, Haselwander and Trinkler used the working cylinder, so to speak, as the first stage of the air-pump by extracting air during the compression stroke from the former as soon as a certain pressure (about 100 lbs.) was reached, and only producing the differential pressure for the injection air (700 lbs. to 900 lbs.) in the actual air-pump. Haselwander had his air-pump combined direct with the working piston by a differential arrangement; whereas Trinkler provided a special air-pump in the cylinder cover. Other designers proposed an intermediate process between those of the ordinary gas-engine and the Diesel engine. Thus Sabathé advocated compression up to about 300 lbs., and artificial ignition of part of the fuel. The Brons motor, as still carried out by the Gasmotoren-Fabrik Deutz for smaller units, has similar features.

Generally, however, it can be stated that most of the above-mentioned propositions have disappeared, and some have not even been carried out; all of them giving place to the Diesel principle with the following characteristics: Compression in the working cylinder up to the ignition temperature of the fuel (about 500 lbs. or about 1000° Fahr.), and creation of the pressure of the injection air (600 lbs. to 850 lbs. per square inch), by means of which the fuel is introduced atomized into the cylinder in an independent multiple-stage air-pump. It is only natural, said the author, that the development of this principle caused some difficulties in the beginning. In the hitherto known steam-engine, the working process takes place partly in the boiler and only partially in the working cylinder. The boiler, which has no moving parts, deals with the heaviest part of the process, and furnishes the working fluid in a refined state to the working cylinder; whereas with the Diesel engine the whole process has to be dealt with in the working cylinder. That it has been possible, within a comparatively short period, to develop this engine to such a degree as to enable it to compete successfully with the steam-engine also for large units, is proof of the present-day skill and thoroughness of engineering. Mr. Schubeler stated that, as regards reliability, the Diesel oil-engine can now be considered as fully equal to the steam-engine; it being only a question of economy in each individual case which of the two prime movers takes preference.

There was one principal difficulty which had to be overcome. The extreme high pressures and temperatures of the Diesel process put a limit to the dimensions of the cylinders, which will hardly exceed a diameter of 30 inches. This corresponds to an approximate cylinder output of 300 to 400 H.P., assuming 150 revolutions per minute of the shaft and the ordinary Otto cycle. Theoretically there would be nothing in the way to obtain any desired output by arranging any number of cylinders side by side. Practically, however, it is not advisable to provide for more than six cranks, as a larger number would produce an inadmissible twisting of the shaft. Furthermore, such units require a great amount of space, and would become extremely costly.

These reasons called forth the necessity of seeking other means by which to increase the specific cylinder output of the ordinary single-acting Otto-cycle engine. For this there are the following possibilities: (1) By carrying out the single-acting Otto-cycle machine as a double-acting one; (2) by adopting the single-acting two-stroke cycle working process; and (3) by adopting the double-acting two-stroke cycle working process. The double-acting Otto-cycle cylinder under the first possibility corresponds approximately to a doubling of the cylinder output. Almost the same result can be obtained by the procedure under the second, which, however, necessitates, as will be explained later on, the provision of special scavenging pumps. The solution under the third possibility would theoretically even quadruplicate (in fact, about 3·4) the output of the ordinary Diesel engine cylinder, and mean the adoption of the usual working process of steam-engines also for the oil-engine.

The author tried to throw a little more light on the foregoing solutions, in order that their respective advantages and disadvantages might be seen. He explained that the subject had not developed so far as to permit any definite statement with regard to which of the solutions would be ultimately adopted for the large Diesel units. It had, however, been ascertained that for smaller and medium size units the single-acting Otto cycle took the preference—this involving the smallest working strain on the cylinder. Though this type of engine necessitates a more or less frequent cleaning of the internal parts, especially of the exhaust-valves, the author said he was informed that such machines had worked for periods of six to eight weeks without interruption, even in cement factories and in mills. He then proceeded to make the following remarks.

The normal type of the single-acting four-stroke cycle engine is a vertical one with trunk piston and without special crosshead. This has not only the advantage that the wear and tear of the piston is very slight, but also others with regard to the construction of the fuel-valve and the symmetric shape of the combustion chamber. The space required is comparatively small, which is frequently to-day an important advantage, and permits of good utilization of the foundations upon which the enormous free forces of the cylinders are transmitted vertically. The horizontal type, which is carried out by various firms, is specially suitable where small heights are essential, and resembles in its construction that of the normal gas-engine. The free forces are more awkward to deal with, and some difficulty also arises with regard to the formation of the combustion chamber and the introduction of the fuel into the cylinder.

The author proceeds first with the single-acting two-stroke cycle engine. The first trials with a Diesel engine of this type were made some ten years ago. Owing, perhaps, to the choice of too small an output, and also some other inadequacies, this first attempt was not repeated for some time. It may be useful to recall some of its principal features. An exhaust-valve is dispensed with; the piston uncovering (at the end of its outward or downward stroke) slots arranged in the cylinder wall through which the burnt gases escape from the cylinder. By means of a special scavenging pump, an air pressure of about 4 lbs. is produced. This lightly compressed air enters the cylinder through a valve arranged in the cylinder cover, drives the burnt gas out of the cylinder, and fills the latter again with a new charge of air as soon as the piston in its upward motion covers the slots. The air-valve being closed, the air is compressed as in the ordinary Otto-cycle engine, and also the fuel introduced in the same way at the end of the upward stroke. The whole process of driving out the gases and the refilling of the cylinder takes place within a very short time at the end of the outward or downward stroke. The length of the slots is about one-fifth of the stroke. With the ordinary Otto-cycle machine, two entire strokes are available for this process, giving, however, thus only half the number of impulses which can be obtained with the two-stroke cycle type.

As to the two-stroke cycle process, this is the same as the well-known one employed with the highly-developed gas-engine of Körting or Oechelhaeuser. It will be seen from the following that it is even more suitable for the Diesel engine. The two-stroke cycle gas-engine scavenges also at the stroke end with fresh air; the difference, however, being that already at this stage of the process the combustible mixture is introduced into the cylinder by a special gas-pump, and this even before the exhaust slots are entirely closed. It therefore cannot be avoided that part of the combustible gases escape unused in the exhaust—creating thereby a possible danger for the engine. With the Diesel engine, the fuel is only introduced at the end of the compression stroke; thus preventing any losses of fuel and danger of pre-ignition. The Diesel engine has, furthermore, the advantage that the rather bulky and power-absorbing gas-pump can be dispensed with. It has also been ascertained that two-cycle gas-engines show an increased fuel consumption at partial loads; whereas the two-stroke cycle Diesel engine has, with smaller load, consumptions which only differ slightly from those obtained by normal load.

With regard to the fuel consumption in general, it must, of course, be expected that the consumption of the two-cycle engine is somewhat larger with respect to the effective output than for the single-acting Otto-cycle engine. This must amount at least to the percentage of the energy absorbed by the air-pumps. There must also be another increase due to the short clearing and filling process of the cylinders, which does not allow as perfect a scavenging as with the four-cycle engine. With the latter under its worst conditions, about 7 to 10 per cent. of the cylinder volume (representing the compression space) is liable not to be fully replaced by fresh air.

As a main advantage, it may be mentioned that the turning moment is much more favourable; and consequently the revolving masses for obtaining a certain degree of cyclic variation are much lighter. The two-cycle engine furthermore guarantees a better starting and better conditions for regulation, which is specially important for direct coupling with alternators. The space required is considerably smaller, and the engine is also lighter, and therefore cheaper. To give a figure, the difference in price between an ordinary single-acting four-cycle and a single-acting two-cycle engine for a capacity of 1000 H.P. already amounts to from 25 to 30 per cent., which figure would have to be considerably increased if larger units were compared. Furthermore, the consumption of lubricating oil is somewhat smaller per horse power, as the same cylinder and bearing dimensions are sufficient for producing about double the output.

It still remains for reference to be made to the chief advantage of the two-stroke engine—that is, the elimination of the exhaust-valve (or two with larger units). Some difficulties cannot be avoided with the latter, as soon as it attains larger dimensions. Generally speaking, the fewer working parts coming into contact with the hot gas the better. The scavenging-valve (or valves) in the cylinder cover may be dispensed with. Only some of the cylinder slots are then used as exhaust slots; the remainder,

on the opposite side, being utilized for the introduction of the scavenging air. A special shape is given to the top of the piston to guide the current of air and guarantee a thorough removal of the burnt gases. The scavenging-valve is thus removed from the high temperatures, and only the fuel-valves and starting-valves are exposed to them.

It is self-evident that, for the continually advancing engineer, the problem of the double-acting Diesel engine was attractive, especially as he already had excellent models in the gas-engine, for which the stuffing-box problem may be regarded as solved. On the other hand, it must be admitted at once that with the Diesel engine the conditions to be dealt with are much more unfavourable, only to mention the higher pressure. It will therefore be preferable to avoid the difficulties with the stuffing-box in the first instance, and to develop the new type on the lines of the single-acting four-stroke cycle engine; this all the more as the gain in output is practically the same.

To go at once to the double-acting two-cycle engine without first gaining experience with the single-acting engine, seems to the author not to lie in the course of a natural development, and to be somewhat risky. As to the design of an engine of the latter type—viz., the double-acting two-stroke engine—this favours the provision of a special crosshead and also the horizontal arrangement. This being so, it may be derived from gas-engine and steam-engine practice that, for the support of the pistons, a rear stuffing-box with bearing support for carrying the weight of the pistons has to be provided, which is certainly far from being desirable. In addition, great inconvenience is caused by the piston-rod having to pass through the combustion chamber, and necessitating an eccentric introduction of the fuel. The combustion process must therefore be far more unfavourable, and the construction of the valve-gear more complicated. The proper setting of the two compression clearances on both sides of the piston is not so simple as with the single-acting engine, where, by a shortening or lengthening of the connecting-rod, the compression can be proportioned to any amount desired. With the double-acting machine, a compromise has always to be made; and the length of the piston-rod has to be provided for an average compression on both sides.

The constructive details of the various types of Diesel engines may be described together, as a large number of the component parts remain the same whether used for one type of engine or another. This applies especially to the fuel-pump, fuel-valve, air-pump, piston, &c. The air-pumps are to-day generally carried out as two-stage or three-stage piston-pumps with inter-coolers. Whereas smaller units have, as a rule, an air-pump attached to each cylinder, driven by a lever from the connecting-rod, it is a general practice to provide for larger units one large common air-pump producing the injection air for three or more cylinders. The pump may be arranged either horizontally or vertically at one end of the bed-plate. This arrangement reduces the number of engine parts to be controlled, and also the first cost. The valves are generally metallic ones, which alone are able to stand the high temperatures.

For lubricating the cylinders, special small oil-pumps—that is, one for each cylinder—are provided. For bearings, connecting-rods, &c., forced lubrication is generally advocated. The pump for the forced lubrication is driven direct from the shaft, and may be a piston or cog-wheel pump. The motors fitted with forced lubrication are totally enclosed; the dripping oil being gathered in the bed-plate, and sucked up again by the pump after having passed through filters and coolers. Oil-holes are bored in the shaft and connecting-rods, which take the oil from the bearings up to the respective crosshead pins and other places where lubrication is required. The cylinders are always cooled—the pistons only from a certain size upwards.

For piston cooling, several solutions are possible; in most cases, a telescopic arrangement being provided. The disadvantage of this solution is the necessity of providing a stuffing-box to prevent leaking water getting into the plate and mixing with the lubricating oil. A very simple arrangement for cooling the piston, which does not require any stuffing-box, and the working of which is absolutely reliable, deserves mentioning. With this arrangement, the water does not entirely fill the cooling space of the piston; the water being only squirted against the highly-heated surfaces, and draining off through a pipe which surrounds the spray-pipe. By this arrangement all additional pressures and strains are eliminated. Some firms use oil for piston cooling. This may have some advantages; but, on the other hand, it has the disadvantage of a smaller cooling effect, owing to the smaller specific heat and the smaller coefficient of transmission of this liquid.

With regard to the regulating process of the Diesel engine, in practically all types the fuel-valve is operated through levers and rollers by cams fixed on a side shaft, which open the valve during from 10 to 15 per cent. of the stroke, irrespective of load. The amount of fuel allowed by the regulator for any specified load accumulates around the fuel-valve spindle in a space filled with the highly-compressed air, which at the opening of the spindle forces the oil through an atomizer into the cylinder. At smaller loads, the regulator acts upon the fuel-valve in such a way as to reduce its quantity. The fuel-pump has a constant stroke, and the regulating of the fuel quantity takes place by the governor acting upon the suction-valve, through which part of the fuel thus flows back into the suction-chamber. If a greatly reduced oil quantity is delivered to the fuel-valve, or, in other words, at small loads, it may happen that no ignition is effected, probably on account of the great air surplus extinguishing the forming flame. To avoid this, the air pressure has to be reduced at smaller loads, which is done by hand in the case of smaller engines. Should this regulation be forgotten, no danger arises from the engine; the result being only a decrease in the number of revolutions until the regulator again delivers a somewhat increased fuel quantity. For larger engines, and especially where the conditions for synchronizing are more stringent, the regulation of the injection air is done automatically by the regulator.

A question which is of the greatest interest both to the manufacturer and to the client is the choice of fuel. It is certainly very surprising that the results of chemical analyses of different fuels do not furnish exact information with regard to the suitability of the fuel for Diesel engines, so that this can only be decided by the actual tests. It happens that oil of a certain composition is quite satisfactory, whereas another of an absolutely similar consistency is unsuitable. It may be stated here that there is a large selection of cheap liquids available, the most important being crude mineral oils and mineral oil residues (crude naphtha, mazout), gas oils—that is, the intermediate products of oil refineries from which the lightest constituents, such as benzine and petroleum have been distilled—and the gas-oil tars of water-gas works. More recently it has been found possible to utilize the bye-products of the distillation of coal and paraffin, tar, solar, and paraffin oil. Explosions or danger of fire on account of the high flash-point are eliminated; and any quantities of such fuel may be stored without danger, and without being subject to the restrictions made by law.

The various working conditions of Diesel oil-engines naturally require different types. The piston speed is generally between 600 and 1000 feet per minute; and it cannot be reduced below a certain limit, as otherwise the slightest leakage could prevent the compression attaining the required amount. It can, however, be as low as 180 to 200 feet per minute for continual service.

For standard slow-speed single-acting four-cycle engines, the number of revolutions lies between 150 and 300 at the respective capacities of 1000 to 1500 H.P. These engines have the best fuel consumption, but have also the disadvantage that they are heavy and expensive. For this reason, a single-acting multiple-cylinder high-speed four-stroke cycle engine was created, which is especially suitable for direct coupling to dynamos. The speed varies between 220 and 350 revolutions per minute at units varying between 1000 and 100 H.P. These high-speed types, if suitably designed and carried out by first-class manufacturers, are just as reliable in service as the slow-speed ones. They have, however, a slightly higher fuel consumption. On account of their smaller first cost, they are especially suitable where the Diesel engine is intended as a stand-by. Single-acting two-stroke engines, with outputs ranging between 700 and 3000 H.P., are carried out with speeds of 160 to 140 revolutions per minute.

The author next dealt with the application of the Diesel oil-engine for ship propulsion, and concluded as follows: One word is required as to the thermal conditions of the engine. The calorific efficiency may attain 30 to 40 per cent.; 25 to 30 per cent. is lost in the cooling water; the rest is contained in the exhaust gases. Of the latter, about 20 per cent. can eventually be utilized for heating purposes; and in adding also the heated cooling water, the total efficiency of a Diesel unit may go up to 80 per cent., which is certainly remarkable. With regard to the actual costs per B.H.P. hour, in assuming a fuel price of 50s. per ton (which is certainly an outside figure), this will amount to about 0·11d. to 0·13d., or about 0·16d. to 0·2d. per kilowatt-hour. These are the figures maintained during actual service, assuming, of course, that the engines are kept in good condition.

RADIATION IN EXPLOSIONS OF COAL GAS & AIR

By W. T. David, B.Sc., of Trinity College, Cambridge.

[Abstract of a Communication to the Royal Society.]

This paper contains the results of experiments on the radiation emitted by mixtures of coal gas and air during explosion and subsequent cooling carried out in the Engineering Laboratory at Cambridge. In the first part, measurements of the total radiation emitted by gaseous mixtures of various strengths and densities are given; and the second part consists of an investigation into the transparency and emissive power of the hot gaseous mixtures after explosion.

The gaseous mixtures were exploded in a plain cylindrical cast-iron vessel 30 cm. in diameter and 30 cm. in length, and were in all cases ignited by means of an electric spark in the centre of the vessel. Into one of the end covers there was screwed a gun-metal tube, which carried at its inner end a plate of diathermanous substance (a plate of fluorite was generally used), and behind it was placed a platinum bolometer with a blackened surface. The bolometer thus received all the radiation from the hot gaseous mixture which was transmitted through the plate of diathermanous substance. In order to measure the heat received by the bolometer, its rise of electrical resistance was measured. The galvanometer, whose deflections were proportional to the rise of resistance of the bolometer, was of low period, and carried a light concave mirror by means of which a spot of light was focussed

on to a revolving photographic film rotating at a known speed. Thus a continuous record of the rise of resistance of the bolometer, and therefore of the heat received by the bolometer, was obtained. At the same time, and on the same film, a continuous record of the pressure of the gaseous mixture was also taken by means of a Hopkinson optical indicator.

The main results obtained from the experiments are:

PART I.

When mixtures of coal gas and air of various strengths, at atmospheric density, are exploded in the vessel when its walls are blackened over with a thin layer of dull black paint.

(1) The total amount of heat lost by radiation to the walls of the vessel up to the moment of maximum pressure is roughly proportional to the product of the third power of the maximum absolute temperature attained into the "time of explosion."

(2) The total radiation lost to the walls during explosion and subsequent cooling is about 25 per cent. of the heat of combustion of the gas present in the vessel.

(3) The emission of radiation in the initial stages of cooling after explosion is a function of the time from ignition as well as of the temperature. The emission varies very rapidly with the temperature and the time from ignition.

(4) In weak mixtures (and probably also in strong mixtures) the rate at which radiation is emitted is a maximum some time before the attainment of maximum pressure, and probably occurs at the moment when the flame fills the vessel.

(5) Weak mixtures radiate much more powerfully in the initial stages of cooling after explosion than stronger mixtures do when they have cooled to the temperatures as the weaker mixtures have in this epoch.

(6) Carbon dioxide emits radiation about twice as strongly as an equal volume of water vapour at the same temperature does.

In explosions of mixtures of the same strength but of various densities.

(7) The total heat lost by radiation per cent. of the heat of combustion of the gas present in the vessel up to the moment of maximum pressure decreases as the density increases.

(8) Denser mixtures emit radiation much more strongly than thinner mixtures—especially at the moment of maximum pressure and in the initial stages of cooling. The emission varies approximately as the square root of the density.

PART II.

The following results refer to experiments made in a vessel of the same dimensions whose walls were silver-plated, and therefore could be made reflecting or absorbent at will. The experiments were made with the bolometer placed at some distance behind the plate of fluorite, so that the emission was measured from a cone of gas of small solid angle.

(9) The intrinsic radiation from a gaseous mixture at any given temperature after explosion depends largely on the reflecting power of the interior surface of the explosion vessel, and also on the size of the vessel. The greater the reflecting power, or the greater the size of the vessel, the greater the intrinsic radiance. This effect is probably due both to greater vibratory energy and to greater transparency of the gas in the larger vessels and in the reflecting vessels.

(10) (*a*) Gaseous mixtures after explosion in a vessel with reflecting walls are very highly transparent to the radiation which they emit at maximum pressure and throughout cooling. (*b*) Gaseous mixtures after explosion in a vessel with black walls are very highly transparent at the moment of maximum pressure and also in the initial stages of cooling. Later on in the cooling, they become fairly opaque.

[(11) to (14) refer to coal gas mixtures of same strength but of different densities.]

(11) The ratio of the intrinsic radiance from a definite thickness of gaseous mixtures of the same strength at any given temperature when the walls of the explosion vessel are reflecting to that when the walls are black, decreases as the density increases.

(12) When the walls of the explosion vessel are black, the transparency of a thickness of gas inversely proportional to the density at any given temperature increases as the density increases.

(13) (*a*) The intrinsic radiance from a definite thickness of gaseous mixture at any given temperature after explosion in the vessel with black walls varies as the square root of the density. (*b*) The intrinsic radiance from thicknesses of gas inversely proportional to the density varies as the fourth root of the density.

(14) The intrinsic radiance corrected for absorption from 1/D cms. of the gaseous mixtures at any given temperature in the vessel with black walls seems to decrease as the density (D) increases.

(15) The radiation (after correcting for absorption) from the hot gaseous mixture after explosion varies with the temperature approximately as Planck's formula for a single wave length of 3·6 μ. This at high temperatures (1800° C. abs. to 2400° C. abs.) varies approximately as the square of the absolute temperature.

Many of the above results may be explained in terms of the following theory. A molecule, as it describes its free-path, loses energy owing to the emission of radiation, and gains energy owing to the absorption of energy from the ether; and the vibratory energy of the molecule will increase or decrease according as the absorption is greater or less than the emission. During collision with another molecule, there will be a transference of energy between the vibratory energy and the rotational and translational energies, which, as Mr. Jeans has shown, will be very rapid if the duration of collision is comparable with the periods of vibration of the molecule. In the case of carbon dioxide and steam at high temperatures, the duration of collision between the molecules is probably short in comparison with the periods of their low-frequency vibrations; and the vibratory energy of the molecules will, therefore, tend to take up during collision a value such that the energy in each of the vibratory degrees of freedom equals that in each of the rotational and translational degrees. During collision, therefore, the vibratory energy of the molecules will tend to take up a value which is proportional to the absolute temperature; but during the free-path there may be considerable departure from this value if the energy density in the ether is above or below a certain value, and the time of description of free-path is not very short. The average value of the vibratory energy of the molecules will, therefore, depend not only upon the temperature of the gas, but also upon the value of the energy density in the ether, the rate at which the molecules emit radiation, the time of description of free-path (inversely as the density of the gas), and the rate of partitioning of energy during collisions. From result (4), it is highly probable that the violence of combustion during explosion causes a considerable part of the energy of combination to pass into the form of internal vibrations of the carbon dioxide and steam molecules. Part of the energy in these vibrations is lost by radiation; but the greater portion is transformed into rotational energy and translational or pressure energy.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

The Publicity and Special Purposes Committee of the Institution of Gas Engineers.

SIR,—I have pleasure in informing you that, at the meeting of the Bradford City Council held yesterday, the recommendation of the Gas Committee to contribute, upon the 2s. 6d. basis, to the Publicity and Special Purposes Fund of the Institution of Gas Engineers was agreed to without opposition and confirmed.

CHAS. WOOD.

Bradford, Aug. 2, 1911.

SIR,—In your issue of the 1st inst., the name of this Company is included in the list of undertakings promising support to the Publicity and Special Purposes Fund. It will perhaps prevent misunderstanding if you permit me to point out that my Directors have promised support only to the Special Purposes section of the Committee's work.

F. M'LEOD, Secretary,
South Metroplitan Gas Company.

709, *Old Kent Road, S.E., Aug.* 2, 1911.

Corrosion of Service-Pipes.

SIR,—I had expected that my previous letter on this question would be the last with which I need trouble you. The somewhat remarkable letter from Mr. M'Leod in your last issue, however, claims some reply.

It would be as easy as it is tempting to follow Mr. M'Leod in the somewhat acrimonious tone he has contrived to give to this discussion. Personalities have, however, no attractions for me. Whether any other of your readers has discerned any traces of "irritation, lack of candour," or undue consideration of "personal dignity," I do not know. But I am quite certain that they were not present to my own mind. It is well to remember that abuse is not argument. It merely betokens a weak case.

The question at issue really resolves itself into this, Is it a misnomer to speak of a subsoil admittedly containing acids as acidiferous? To my mind, the question only admits of one answer.

May I, in conclusion, remind Mr. M'Leod that two of the most elementary maxims of controversy are: (1) Never impute unworthy motives to your opponent; and (2) give your opponent credit for the same sincerity which you claim for yourself. Both these are transgressed in his last letter.

WALTER HOLE.

Leeds, Aug. 3, 1911.

Belfast Gas-Works Report.—When the minutes of the Gas Committee came before the quarterly meeting of the Belfast County Borough Council, Mr. Curley said he was glad to find that the report on the gas-works for the past year (*ante*, p. 122) had been so satisfactory; and he hoped in future, after the necessary changes had been carried out at the works, they would have even more gratifying reports.

The Pipe-Contract Dispute at Lincoln.—At the meeting of the Lincoln City Council last Tuesday, the Mayor (Mr. C. H. Newsum), alluding to the recent action by the Staveley Coal and Iron Company, said it had been argued that it was not the Corporation's business to go into the Law Courts at all; but he differed. They did not go into Court until they were absolutely certain of the case; and then they owed a duty to commercial morality. They had won the case because justice was on their side; and there were two men in particular to whom the citizens owed a debt of gratitude. He referred to their Town Clerk (Mr. W. T. Page), and the Water-Works Engineer (Mr. N. M'K. Barron). Mr. Milner, while agreeing with everything the Mayor had said, thought a great deal of credit was due to the man who tested the pipes at the other end, because had it not been for him the action might possibly not have been brought.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Read a second time and committed: St. Helens Corporation Bill.

Bills reported: Halifax Corporation Bill, Ipswich Corporation Bill, Margam Urban District Council Bill, Rotherham Corporation Bill, St. Helens Corporation Bill.

Bills read the third time and passed: Belfast Corporation Bill, Gloucester Corporation Bill, Ipswich Corporation Bill, Local Government Provisional Orders (Gas) Bills (Nos. 1 and 2).

HOUSE OF COMMONS.

METROPOLITAN WATER BOARD (NEW WORKS) BILL.

After the second reading of this Bill on Monday last week,

Mr. EMMOTT (the Chairman of Ways and Means) moved: "That the Standing Orders relative to the committal stage of Private Bills be suspended, and that the Bill be ordered to lie upon the table."

Mr. NIELD, who had given notice of motions for the rejection of the Bill, and, in the event of its being read a second time, for its re-committal, said the County of Middlesex had very serious objection to the measure unless some protection was afforded to those whom they represented. The district in which it was proposed to construct reservoirs Nos. 6 and 7 was mainly occupied by cottagers and small holders who required an ample supply of water if they were to carry on their business at all. There was a danger that the wells upon which they depended would be deprived of water by the pumping operations necessary in the construction of these reservoirs; and all the Middlesex County Council asked for was protection to persons living within two miles against any temporary interference with their water supplies caused by the works.

Mr. MILLS remarked that during the construction of the reservoirs pumping operations would be necessary, and their effect would be to abstract the water from the wells in the surrounding neighbourhood. What he desired was that the Water Board should be compelled to insert in the Bill a provision that compensation should be given to the owners of such wells. He asked the House to re-commit the Bill in order that it might be arranged that the proposed reservoirs should be placed in situations in which they would be as useful and as cheaply constructed as they would be in the positions now indicated, and that they should not interfere with a pretty reach of the Thames.

Mr. J. WARD said the proposed works were subsoil reservoirs, and therefore must be placed in a low-lying area. The average depth of the trenches to be formed would be about 30 feet. The experience he had gained during many years of work beside the Thames led him to believe that there was not the slightest ground to fear the dangers suggested by the honourable members who had spoken. The desire appeared to be to put as many obstacles as possible in the way of the Water Board. Speaking with practical knowledge, he did not believe that any of the suggested works would have the dire effects honourable members had imagined. He had listened to much of the evidence given before the Committee who had considered the Bill, and he thought that the proposals now in it were reasonable, and carried with them no danger to private interests.

Mr. BURNS said the Bill had been before a Joint Committee, by whom it had been under discussion from March to June. A large number of witnesses gave evidence, and 64 petitioners were heard. Originally, the proposal was for eight reservoirs on the banks of the Thames. The Water Board were well advised in withdrawing the proposal for No. 8, and later Nos. 2, 3, and 4 were struck out by the Committee. In the result, only three of the eight reservoirs remained; and those nearest the river were not to be proceeded with. The objections to the Bill were quite general. No specific injury had been shown, and no particular danger proved. The Middlesex County Council alone were complaining; but, as they could not give any evidence of damage, why should the Water Board and the public be put to unnecessary expense? On mere allegations of the possibility that somebody might be injured, and without any evidence, it was not fair that the vast undertakings of the Water Board should be further handicapped. He appealed to the House not to hamper the Board's operations, and defer works which were necessary in order that London might enjoy a cheap, permanent, and continuous water supply.

Mr. JOYNSON-HICKS said the right honourable gentleman had no right to make a point of the fact that five of the eight original reservoirs had been withdrawn. This was done because they ought never to have been included; and assuming that the Committee were right in striking them out of the Bill, it was an act of folly to have included them. It had never been suggested that the reservoirs were going to be filled by subterranean water, but that during the period of their construction the underground water would be temporarily drained for a considerable distance. It was admitted by the promoters of the Bill that this would be the case; and he contended that if damage should occur, the House ought to see that adequate compensation was provided for the benefit of the people who were dependent on the water for their livelihood.

After some remarks by Mr. GLYN-JONES and Sir FREDERICK BANBURY, Mr. Emmott's motion was agreed to.

The following further progress has been made with Bills:—

Lords Bills read a second time and committed: Gas Orders Confirmation Bills (Nos. 1, 2, and 3), Rhondda Urban District Council Bill [Lords].

Lords Bills reported: Gas Orders Confirmation Bills (Nos. 1 to 4), Merthyr Tydfil Corporation Water Bill, Rhondda Urban District Council Bill.

Lords Bills read the third time and passed: Gas Orders Confirmation Bills (Nos. 1 and 3), Kingston (Hull) Corporation Bill

UXBRIDGE GAS ORDER.

Gas-Mains and Steam-Rollers.

The Gas Orders Confirmation (No. 4) Bill, which includes a Provisional Order promoted by the Uxbridge Gas Company, came before the Select Committee of the House of Commons presided over by Sir EDWIN CORNWALL on Aug. 3.

Mr. C. C. HUTCHINSON, K.C., and Mr. PADDON appeared for the promoters; and the petitioners opposing the Bill, the Hertfordshire County Council, were represented by Mr. HONORATUS LLOYD, K.C., Mr. TYLDESLEY JONES, and Mr. G. HALSEY.

Mr. HUTCHINSON explained that the Order provided for an extension of limits of supply of the Uxbridge Gas Company, and for empowering the Company to maintain, continue, and enlarge existing gas-works and to supply gas in the parishes of Flaunden and Sarratt, in Hertfordshire, and the parishes of Chenies, Amersham, Penn, Little Missenden, Great Missenden, and part of Hughenden in Buckinghamshire. The Hertfordshire County Council were petitioning for a protective clause, which should save them from liability for any loss or damage caused by, or arising out of the reasonable exercise of, their powers or duties as a road or bridge authority. This the promoters were willing to concede them in principle; but the point in dispute was as to the interpretation of the word "reasonable." The County Council desired it to be enacted that the use by them of a steam-roller or other engine not exceeding 15 tons in weight should be deemed to be not an unreasonable exercise of their powers or duties. The promoters could not admit this at all. Up to 1906, the Company had exercised their powers in relation to the breaking-up and making of roads under the Gas-Works Clauses Act, 1847. In 1906, however, when the Company came to Parliament for an extension of area, the Middlesex County Council submitted that the traffic had so changed—that it had become heavier and more frequent, that it consisted so much of motors and traction-engines and so forth—that the provisions of the 1847 Act were hardly applicable to the present day. Parliament was convinced, and put upon the Company a clause (No. 54 in their 1906 Act) which gave to the County Council protection in addition to what they had under the Act of 1847. The Middlesex County Council had had five years' experience of this, and had found it satisfactory. It was proposed in the Bill to give the same protection to the Buckingham and Hertford County Councils. The former were satisfied, but not the latter, who demanded greater protection than Middlesex, where the traffic was much heavier and more frequent. The House of Lords Committee had decided that the Hertford County Council's demand was unreasonable [*ante*, p. 182], and he hoped a like decision would be come to in this House.

Mr. *Harry Jones*, examined by Mr. PADDON, said he had had special experience of gas undertakings in Hertfordshire, Buckinghamshire, Middlesex, and Essex, extending over forty years. He had never known any friction or trouble to have been occasioned by gas companies and local authorities working under the Gas-Works Clauses Act of 1847. He had always been able to satisfy the surveyors, and had never been before the Justices on the question of laying pipes, &c.

Mr. HONORATUS LLOYD, in cross-examination: Are you aware that the Hertford County Surveyor told the House of Lords Committee that the roads have a weak foundation?

Witness: If so, he must be careful what weights pass over them.

Assume that the roads have a weak foundation, we use steam-rollers of 12½ tons and sometimes 15 tons, and you are yet willing to lay your pipes therein?—I am subject to the opinion of the Justices whether I am deep enough to be safe.

And you want to cast upon the County Council the burden of paying you damages in the event of the pipes being broken?—If they have been using a steam-roller of a particular weight, I know the road has a solid foundation, and that therefore I would be safe there. If a similar roller to that which has been used is brought to the roads again, and used reasonably and fairly, then I do not mind.

I want to be able to maintain my own roads with a 15-ton roller as in the past?—I dispute that a 15-ton roller is a reasonable instrument. A 6-ton roller is now more usual.

In re-examination, witness said that all the Company wanted was to prevent the County Council using appliances in an unreasonable manner, and of an undue weight in certain cases. If one of the Company's pipes were broken, the question to be decided by the Courts would be whether there had been reasonable user of the road.

Mr. *Charles Carpenter*, the Chairman of the South Metropolitan Gas Company, in reply to Mr. PADDON, said he was familiar with the conditions under which gas undertakings round London were carried on. The Gas-Works Clauses Act, 1847, had been found satisfactory. The situation was briefly that if a gas undertaker laid his mains in a road having regard to the traffic that obtained prior to his laying them, with all due care, and in the way the latest knowledge and practice dictated, and if a steam-roller of any weight broke the mains, then the question to be decided was whether the mains were properly laid or whether the steam-roller had been improperly used. But if the clause asked for by the Hertfordshire County Council was granted, with its provision that the use of any steam-roller or other engine which did not exceed 15 tons in weight should not be deemed to be an unreasonable exercise of the road authority's powers and duties, it would stop the Court from considering whether the use of the road was reasonable or unreasonable. Thus, however well the pipes were laid, the Company would be unable to get any redress from the Court. He regarded the use of 15-ton rollers as a retrograde step. The South London local authorities were using lighter rollers, and found them more satisfactory. The effect of the clause would be to deprive the Company of their common law right by stopping the Courts from deciding what was reasonable or unreasonable. Under certain circumstances, the use of even a 5-ton roller might be unsafe on a road with a weak foundation—for instance, after a flood, frost, and thaw.

Mr. HONORATUS LLOYD, cross-examining: Suppose the road has a weak foundation, and the Company, knowing the whole of the facts, ask to be allowed to lay mains, no matter at what depth, under certain conditions it may be unsafe?

Witness: Yes.

Suppose the Justices decide 3 feet, that you lay the pipes at this depth, and they are injured, then you want the ratepayers to pay you?—Yes; because the County Council ought not to use a steam-roller under such conditions.

Mr. HUTCHINSON said he did not think the Hertfordshire County Council required any more protection; but he was willing, if the Committee thought fit, to allow them the following clause:

The County Council shall not be liable for, or in respect of, any damage or injury to any mains, pipes, or other works of the undertakers laid down or constructed under the powers of this Order in or on any highway, or bridge, or the roadway over a bridge, or the approaches thereto, caused by the reasonable use of road-rollers and other road plant, or resulting from reasonable exercise by the County Council of the powers vested in them.

Mr. HONORATUS LLOYD intimated that he did not intend to call any witnesses on behalf of the County Council, but would confine himself to stating their case. The Company, he said, were asking for the privilege of coming into Hertfordshire and laying their mains in the roads. These roads had weak foundations, and the County Council used upon them 12½-ton and 15-ton steam-rollers. Being warned that those were the existing conditions, the Company nevertheless asked for the privilege of laying mains, and to be under the common law only. He submitted that, under all the circumstances, it was only reasonable that the protection of the limit of weight should be allowed the Council. What harm could this 15-ton condition do? So far as the clause the Company offered was concerned, he would rather have it than nothing; but it did not go far enough. To his mind, the clause was worth very little. He doubted whether it was worth sufficient to justify the alteration of the general law.

The CHAIRMAN: The Committee do not think you require any special protection at all.

The Committee found the preamble of the Order proved; and the Bill, without amendment, was ordered to be reported to the House for third reading.

SWANSEA GAS BILL.

House of Commons Committee.—Wednesday, Aug. 2.

(*Before Sir* EDWIN CORNWALL, *Chairman, Sir* WILFRED LAWSON, *and Mr.* RONALD M'NEILL.)

The Swansea Gas Bill, introduced in the Lords, came to-day before a Committee of the House of Commons, constituted as above. The Bill was strongly opposed in the Lords by the Swansea Corporation, who now appeared merely in relation to the adjustment of a clause; a settlement on the merits having been arrived at.

Mr. HUTCHINSON, K.C., Mr. TYLDESLEY JONES, and Mr. SZLUMPER represented the promoters; and Mr. VESEY KNOX, K.C., and Mr. REES WILLIAMS appeared on behalf of the Swansea Corporation.

Mr. HUTCHINSON explained that the Bill enabled the Company to increase their capital, and authorized the compulsory acquisition of lands for gas purposes. The opposition was directed to the question of the lands; the capital asked for having been granted in the other House. It was conceded by the Corporation that the Company must have land powers of some kind; the existing works being now very cramped. It was absolutely essential that the Company should be able to put up works which would hereafter provide for turning out something like double the present output. The Company proposed to extend the existing site by acquiring the property which bound the works on the Wellington and Bathurst Streets sides. The Corporation did not object to this. The Company also proposed to ask Parliament to authorize for manufacturing purposes a piece of land known as Vetch Field, a short distance from the existing works; this having been purchased by agreement some years ago. The other House passed this clause in face of the opposition of the Corporation. The promoters, however, as fellow-townsmen, had since recognized that there might be something in the Corporation's objections, and had agreed not to use Vetch Field for the manufacture of gas, and not to ask for powers in relation to certain property adjoining, by which means they had hoped to extend Vetch Field. The only point now outstanding was as to the form of the clause giving the Company power to use Vetch Field for purposes other than the manufacture of gas and residual products. In the clause which the promoters put forward, they did not declare specifically that the lands were not to be used for manufacturing purposes. They did not consider this necessary, as under the general law they could not manufacture on other than lands scheduled for manufacture.

Mr. *G. T. Andrews*, the Engineer to the Company, stated that they had paid £472 per annum for the last ten years for Vetch Field, in the hope of later on getting power to manufacture. The Company now withdrew the powers they sought in this connection, simply and solely to meet the views of the Corporation. Vetch Field would be used for storage purposes.

Mr. VESEY KNOX asked for the addition to the clause of words binding the Company not to use the lands for the manufacture of gas, or the manufacture, conversion, or treatment of residuals.

Mr. HUTCHINSON argued that if such words were inserted they should certainly be qualified by the phrase "unless hereafter authorized by Parliament."

The CHAIRMAN said he did not like such references to future parliamentary action.

Mr. VESEY KNOX declared that the position of the Corporation was that when the time came for an extension of the manufacturing works the Company should go out of the town, as had been done in Edinburgh and in other places. The Corporation did not want two manufacturing works in the town.

Mr. HUTCHINSON, after some further discussion, proposed the insertion of these words: The Company "shall not manufacture gas, or manufacture or convert residual products, or matters producible therefrom, on such lands."

Mr. VESEY KNOX, having accepted the proposal, the clause was so amended.

The "stand-by" clause in the Bill gave rise to some discussion, on a report from the Local Government Board calling the attention of the Committee to the matter. By this clause, the Company have power to charge up to a maximum of 25s. per quarter to consumers of gas who keep their meters and pipes connected with the mains for purely stand-by purposes, while using some other power or illuminant.

The CHAIRMAN, after various questions to Counsel, said he was surprised that the Corporation had not strenuously fought this clause, which seemed to him most oppressive and unreasonable.

Mr. TYLDESLEY JONES argued that the amount named was the maximum, and was reduced to 5s. per quarter to small users. It was not fair, he said, for the Company to be held as a sort of convenient reserve force, after they had expended capital in providing something which was for the public convenience, unless they had some recompense for doing so.

After further discussion, the Committee decided that the charge should not be imposed in the case of users of gas for domestic purposes only; and with this alteration the Bill was ordered to be reported for third reading.

LEGAL INTELLIGENCE.

Dowson and Mason Gas Plant Company, Limited.

Mr. Justice Neville had before him, in the Chancery Division of the High Court of Justice, on Monday last week, a petition for sanction to the reduction of capital of the above-named Company. Counsel explained that the petition has been presented on the ground that the capital had been lost. The Company was incorporated in June, 1905; the objects being to enter into certain agreements with Messrs. William Beardmore and Co. for carrying out experiments with regard to petrol motor engines. The capital was £60,000, in £1 shares, of which 42,007 had been issued. It was proposed to cancel 21,000 of these shares, which were held by Mr. Beardmore personally and by his Company, both of whom assented. His Lordship made the order.

Damage to Water-Mains by Sewerage Operations.

At an adjourned sitting of the Windsor County Court on the 29th ult., his Honour Judge Howland Roberts gave his decision in a case in which the Slough Water Company brought an action against the Slough Urban District Council in respect of a broken water-main in the Stoke Road on Aug. 30, 1910. There was a counter-claim by the Council against the Company for damages in respect of the main. The claim was for £46 18s. 9d., and the counter-claim for £29 6s. 8d.; and the question was as to who was liable for the fracture of the main and the consequent damage. His Honour decided that it was the result of the negligence of the Council in insufficiently ramming the soil in the trench at the place where the break occurred; and he gave his decision for the plaintiffs. The parties had agreed that damages should be assessed at ten guineas; and judgment was given for this amount. A fuller report of the case will appear next week.

Horley District Gas Company.

In view of the half-yearly meeting of this Company called for Thursday, the report and accounts for the six months ended the 30th of June have been issued. The Directors state that there was a very satisfactory increase of nearly 8½ per cent. in the sale of gas compared with the first half of last year; and there is every probability of this upward movement continuing, as a request has been made by the residents of Hookwood for the Company's mains to be extended to that neighbourhood, and the Directors have decided to comply with it. The accounts show that the revenue was £5322, compared with £4976; and the expenditure £3644, against £3478. The balance carried to the profit and loss account is £1678, compared with £1498 this time last year. The amount applicable for distribution is £1361; and the Directors recommend the payment of dividends at the rates per annum of 5 per cent. on the preference stock, 6 per cent. on the "A" stock, and £4 4s. per cent. on the "B" stock, all less income-tax. The working statements in the accounts show that, under the supervision of Mr. R. Seymour Tobey, the Manager and Secretary, 1790 tons of coal were carbonized in the production of 20,757,400 cubic feet of gas—being at the rate of 11,596 cubic feet per ton. The quantity of gas sold was 18,722,300 cubic feet; leaving 7·37 per cent. unaccounted for. The Company have 633 ordinary and 903 prepayment consumers—a total of 1536; and there are 821 stoves fixed. When the arrangements for the supply of Hookwood are completed, additions to these figures will, of course, follow. To meet this extension, and for the general purposes of the Company, as announced in the "JOURNAL" last week, the Company are inviting tenders for the balance of the 4 per cent. debenture stock (£4400) and (£1440) of additional "B" capital stock.

York United Gas Company.—At the half-yearly general meeting of this Company last Wednesday, the Directors reported that the balance of profit amounted to £8772. Adding the interest on the reserve fund (£366), and after payment of the interest on the debenture stock (£618), there was left a surplus of £8520, which it was recommended should be appropriated as follows: Dividend at the rate of 4 per cent. per annum on £50,000 of preference stock (less income-tax), £942; dividend at a like rate on £370,000 of consolidated ordinary stock (less income-tax), £6968; carried forward, £610. During the half year, 889 yards of additional mains were laid, 238 meters fixed for new consumers, and 720 cookers, grillers, &c., 95 gas-fires and radiators, and 1842 lights fixed. In the absence of Mr. J. R. Hill (the Chairman) through illness, Mr. James Melrose (the Vice-Chairman) presided, and moved the adoption of the report; and the motion was carried. The dividend recommended was declared, and the Directors were thanked for their services.

THE GASLIGHT AND COKE COMPANY.

The One Hundred and Ninety-Ninth Half-Yearly Ordinary General Meeting of the Proprietors was held last Friday, at the Chief Office, Horseferry Road, Westminster—Mr. CORBET WOODALL (the Governor) in the chair.

The SECRETARY (Mr. Henry Rayner) read the notice convening the meeting; and the seal of the Company having been affixed to the Register of Proprietors, the report (given in the "JOURNAL" last week) was taken as read.

FIRST CENTURY AS A STATUTORY COMPANY.

The GOVERNOR: Ladies and Gentlemen,—This meeting is, as the notice has told you, the 199th which the Company has held since it received its Charter. Its first century as a Statutory Company will have been completed, and its second opened, when we assemble, as I hope we all may, in February next. Most of us will, I think, be content if we open the new century with a report equally satisfactory as that which I have now the pleasure to submit for your adoption.

CAUSES CONTRIBUTING TO THE SATISFACTORY RESULTS.

I have once more to remind you that the accounts do not compare on equal terms with those of the corresponding half year of 1910. The price of gas was again reduced at the opening of the year; and this reduction affects the profits prejudicially by more than £50,000. Yet, owing to circumstances which I will explain later, the balance of the revenue account is greater by £17,000, and exceeds by more than £103,000 what is needed for the payment of the dividend recommended. Among the causes which have contributed to this satisfactory result, one of the most important is the improved condition of the capital account. During the half year we have expended of additional capital, £45,653. Of this, £7926 was upon manufacturing works and plant, and the remainder upon mains, meters, and stoves. Against this expenditure of £45,000 there is a credit of £124,000; so that the capital actually employed is less now by £79,000 than it was at Christmas last. Or, it may be more correct to say, the floating balance of capital is increased by this considerable sum. The credit is made up in part by depreciations of works, plant, meters, &c.; the remainder from the sale of surplus land. The Company's large works at St. Pancras were closed for manufacture in 1904. The site, except the portion (about one-half) used for storage, has now been sold to the Great Northern Railway Company; the proceeds of the sale necessarily being applied in reduction of capital. The large sum represented by the plant abandoned at St. Pancras and elsewhere is being gradually redeemed by the operation of the redemption fund, to which we have now contributed £140,000 out of dividend account. As I have remarked before, the closing of the St. Pancras and other expensive stations, and the concentration of the manufacture where the production can be more economically conducted, has contributed largely to the improvement of the Company's returns. The charge for dividend and interest on capital shows a steady reduction.

GAS AND RESIDUALS.

The revenue account tells a tale of improvement all along the line. There is an increase in the sale of gas equal to 4¾ per cent., or 591 million cubic feet. Had the price of gas not been reduced, the revenue due to this greater sale would have been £77,000. As it is, we have covered the loss and have £17,000 to the good. Putting it in another way, our consumers have been supplied with 591 million cubic feet at a charge to them of less than 7d. per 1000 cubic feet. The items of revenue which grow or decline automatically with an increase or decrease in the number of consumers all show improvement—meter-rents, £3000; stove-rents, £4000; fittings, £8000. Residuals also all show increases. Coke yields £49,000 more than in the corresponding half year; breeze, £4000; tar, £12,000; ammoniacal liquor, £13,000—together, £78,000.

ON THE EXPENDITURE SIDE.

Looking to the other side of the sheet, we find that while coal cost £47,000 more and coke used £4000, we spent on oil £14,000 less; so the gross cost of raw material was more by only £37,000. Setting this against the improvement in residuals (£78,000), you will find that the net cost is less by £41,000, which is highly satisfactory. This net cost of coal is one of the lowest in our records, though the gross cost was somewhat high. The quantity of gas made per ton of coal carbonized is greater by 430 cubic feet. The cost of purification is more by £6000, due to a partial return to the use of lime. The amount spent on repairs and renewals of works is £50,000 more than last year. Of the spare plant at our stations, much was antiquated and uneconomical; and this we have been steadily reconstructing on better lines. So long as the expenditure brings in a good return, it will be cheerfully provided for. The cost of meter and stove repairs continues to grow with the number of our consumers. A reduction of £10,000 in the cost of fittings is a matter for regret, as it is due to a falling off in the rate of increase in the number of prepayment consumers connected. In the half year to June, 1910, the number was greater by 6000. While it would be foolish to generalize from the experience of one half year, yet this fall does remind us that there is a limit to the number of possible prepayment consumers in our district, immense though it be. It also justifies the policy adopted by the Directors of acquiring the undertakings of neighbouring small companies, and so obtaining fresh fields for the enterprise of the Company.

CO-PARTNERSHIP BONUS AND PROPRIETORS' DIVIDENDS.

The co-partnership bonus has increased by £3700, consequent on the last reduction in the price of gas. The apportionment of the Company's extra profits in the past two years has hardly been liberal to the shareholders. There have been two reductions in price, giving, together, to the consumers more than £200,000; the co-partners have twice had their bonus increased by ¾ per cent.—the aggregate of the two being £7000; while the stockholders have had one addition of 1s. 4d. per cent. for one half year only, costing £5000. The explanation lies first of all in the reduction of our standard price from 3s. 3d. to 3s. 2d. in 1909; and, secondly, in the addition of £10,000 per annum made this year to the redemption fund. This fund was introduced by the Company's Act of 1903, and it works in such a way that every third penny taken off the price of gas in respect of which the Company distributes an extra dividend makes it necessary for a further sum of £5000 per half year to be carried to the redemption fund; and this extra contribution happens to occur when the price of gas is reduced from 2s. 8d. to 2s. 7d. per 1000 cubic feet. The price was reduced in January; and therefore the shareholders are called upon to contribute the extra £5000. If it were not for this contribution, the increase in dividend for the half year would be at the rate of 2s. 8d. per cent. per annum, instead of 1s. 4d. as it is.

PUBLIC LIGHTING.

Public lamps have cost £4000 more, though the revenue derived from them is less by £6000. Some expenditure has been undertaken in introducing improved burners and lanterns; the new burners giving a much better light for a reduced quantity of gas. In the balance-sheet there is an item of over £40,000 marked as "Alteration of street-lamps." This is made up of sums due from various lighting authorities in our district for work which we have executed for them, and which they will repay by instalments.

SPECIAL PURPOSES FUND.

A sum of £20,000 has again been carried to the insurance fund, which now stands at the satisfactory figure of £213,000. Under the Company's Act which received the Royal Assent in June, we are empowered to form a "special purposes fund" to which will be carried the moneys now standing at the credit of the insurance fund.

FINANCIAL RESULTS AND DIVIDEND RESTRICTIONS.

Quoting the first paragraph of the report—

> The accounts for the past half year show that, after providing for fixed charges, setting aside £15,000 towards the redemption fund, and contributing £20,000 to the insurance fund, as shown in account No. 9, there remains a profit balance of £456,129 4s. 11d. The amount brought forward from the previous half year being £625,688 7s. 4d., there is a total sum available for distribution of £1,081,817 12s. 3d., out of which the Directors recommend a dividend on the ordinary stock at the rate of £4 14s. 8d. per cent. per annum, which will absorb £382,467 10s. 8d., and leave the sum of £699,350 1s. 7d. to be carried forward to the credit of the current half year.

A fairly healthy financial statement. The amount carried forward is a substantial one, but not more so than the security of the Company's dividends justifies. I have had several letters from shareholders complaining that, in view of the largeness of this amount, a higher distribution of dividend is not to be made. These shareholders have not acquainted themselves with the conditions of our Act of Parliament, under which an increase of dividend cannot be made except upon a further reduction in the price of gas. It is only a short time ago that complaint was made that a dividend was recommended which required for its payment a larger sum than had been earned in the half year. Since then the dividend has been thrice increased, and the price of gas reduced four times. These reductions in the price of gas have meant a relief to consumers equal to a present annual saving of £400,000; and we are confident further reductions will in due course take place.

PRUDENCE FIRST.

We are determined, however, so far as possible, to avoid risk of having to retrace our steps and return to a higher price; and to this end a considerable reserve is essential. Circumstances have latterly been favourable to the Company. Adverse fluctuations in the prices of coal and residuals, upon which we so largely depend, might in a short period make a large inroad upon our savings. The Directors are quite satisfied that the course they are pursuing is the right one; and they have no intention of departing from it.

THE NEW ACT—EXTENDING THE COMPANY'S FRONTIERS.

As I have already mentioned, the Company's Bill in Parliament received the Royal Assent on the 29th of June, having had to meet but slight opposition. By it we shall shortly obtain a largely extended district beyond our north-east frontier, which can be economically supplied with gas from our chief works at Beckton. This, I think, should be a matter of congratulation. The new districts will be taken over on the 1st of January next, when the present works will be closed and dismantled.

NATIONAL INSURANCE AND THE COMPANY'S EMPLOYEES.

The National Insurance Bill introduced by the Government is a matter of considerable interest to the Company and its employees. That the Bill, if passed, will be a great advantage to the workers of the country generally is beyond question. At the same time, it is certain that if it is accepted by us in replacement of our present provident funds the result will be materially to the disadvantage of the Company's employees. These provident societies, which have been in operation for a considerable period, are managed largely by Committees appointed by employees, and are working excellently. The workmen have held meetings with the members of their Committees at each of the manufacturing and other stations of the Company. Following upon these meetings, I interviewed the Committees. The report brought by each was to the effect that, if possible, the men should not be brought under the operation of the Act, but that the funds should remain, as now, under the direct control of the Company. I was greatly pleased to find that these opinions had been formed after careful perusal of the Bill itself and the discussions which have so far taken place in Parliament. Observations made by a large number of the Committee members showed an appreciation of the fact that their interests, both in regard to the provident funds and in other directions, are carefully safeguarded by the Board. A letter has been addressed to the Chancellor of the Exchequer asking whether it would be possible that this

GLOVER-WEST
VERTICAL RETORTS

ADOPTED IN

ENGLAND, SCOTLAND, IRELAND, AUSTRALIA, JAPAN, AND UNITED STATES OF AMERICA

AS FOLLOWS:—

ST. HELENS (First Installation),
MANCHESTER,
ST. HELENS (Second Installation),
ROCHDALE,
BRADFORD,
HELENSBURGH,
LURGAN,
TOKIO,
SYDNEY,
FITCHBURG,
NEWCASTLE (NEW SOUTH WALES).

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Company's men may be left outside the purview of the Act; the Company guaranteeing the solvency of the funds.

COAL PURCHASES.

With regard to the future, the Directors have to report that the coal purchases for the next twelve months have been completed at satisfactory prices. This again is a matter of congratulation, especially as the prices for residuals continue good, and the prospects in this direction are excellent.

POSITION OF EMPLOYEE CO-PARTNERS.

The number of co-partners is now 9257; the total amount of their interest in the Company being £103,581 of which £45,752 is held by the co-partners themselves in the form of stock.

MOTION FOR THE ADOPTION OF THE REPORT AND ACCOUNTS.

I beg leave to move: "That this meeting do agree with and confirm the report of the Directors and the Auditors' report and statement of the accounts of the Company as transmitted to the proprietors on the 27th ult."

Mr. ULICK J. BURKE said he had great pleasure in seconding the motion.

The GOVERNOR: We shall be very pleased to hear any observations any shareholders choose to make.

A SHAREHOLDER'S REMARKS.

Mr. W. A. HOUNSOM did not propose for one moment to follow the wonderful figures which had been dealt with by the Governor—wonderful in their magnitude, and also in the success written large across every page of the report—but he rather wanted to take another course. He was very much tempted at the last half-yearly meeting to say a word or two, but they were then, as a Company, face to face with Parliament. On such an occasion as that, he thought it was perhaps wise that the least possible should be said on his side of the table. But they were to-day looking back on a successful Bill, which was now an Act; and he could not help asking for the reasons which had led to the success which had been achieved. It was not many years since that a Bill of the Company in Parliament meant grave anxiety and protracted sittings in Committee; but, during the last half year, the Parliamentary Committee-Room had been changed, so far as this Company were concerned, from a fighting ground to a conference room, and a conference room in which the Committee, the Counsel, and those associated with the Company, more especially the Governor and the officers, had met together with, it might be, a difference of opinion, but they had met together to consult as to how the best possible could be done for all parties connected with the Company, their consumers or customers, employees, and stockholders. The success which had been achieved was, he thought, the happiest augury for the future of the Company. The Governor had, in a few words, referred to the new territory which had been secured, which was so important for the Company's advancement and so important to the well-being of the consumers; they now had a new district. This achievement was, a few years ago, impossible; and he wished to ask his fellow proprietors whence came this great change, and how was it that this meeting, though it might be few in numbers but representing interests so great, could look back on such a great success? He had noticed that Lord Haldane, when speaking the other day at prize givings at a secondary school, said that the greatest quality of that school, which was full of energy and modern spirit, was that it had broken away from tradition. *Mutatis mutandis*, he was prepared to apply these words to the Gaslight and Coke Company. Tradition was only magnificent if it enshrined a lofty ideal; but hide-bound tradition, the tradition of the dead man's hand applied to parchment which prevented anything in the shape of forward movement, was accursed. He congratulated the Board on having broken away from the wrong sort of tradition; and he appealed to his fellow proprietors for the sympathy which was needful with regard to those on his side of the table. The Governor had alluded to some questions of increased dividend and so forth; but he (Mr. Hounsom) appealed to the proprietors to get away from the old-fashioned idea that they were a mere dividend-paying machine, and to take the human interest in its concerns which was now taken by the Board, and which was having such far-reaching effects in connection with the development of the Company's work and its progress. Of course, times of stress might come. It was all very well to meet there to hear these glowing figures; but he wished to develop in the proprietors the feeling of interest which should make the Company one great whole in its progress forward. Every day they won the confidence of their customers, for whom they desired to secure the best means of using the commodity they made. So far as the employees were concerned, the steps taken were bringing them into closer touch with the Company as a whole. Co-partnership tended to the stability of the Company; and it was gratifying to all the stockholders to know that from time to time they took a more and more intelligent interest in the concern, so that they might progress on the highest and best lines, and that in the future they might look forward to increasing usefulness to all who were associated with the wonderful and far-reaching success of the Company. (Hear, hear.)

REPLY BY THE GOVERNOR.

The GOVERNOR: If there are no other observations, I have only to thank Mr. Hounsom for the encouraging and inspiriting words which he has on more than one occasion spoken to us, and which he has followed up to-day. I think there is a great deal in the suggestion that the shareholders should be as one with us as apostles of gas, going up and down among their friends and doing the best they can to make known the advantages we are able to bring to them. Mr. Hounsom quoted Lord Haldane with regard to breaking away from tradition. Only the other day we had the pleasure of seeing Lord Haldane at Beckton—I merely mention this incidentally as it may be of interest to you—to inspect our rifle-ranges; and we paraded some 350 Territorials for his inspection. He was good enough to say that he had never seen rifle-ranges better than those which we provide at Beckton. Whatever we do, we try to do as well as we can.

The resolution was put, and carried unanimously.

THE DIVIDEND.

The GOVERNOR: The Secretary will now read the minute of the Court of Directors recommending dividends for the past half year.

The SECRETARY then read the Directors' minute of July 18 as to dividend.

(1) That the sum of £15,000 be set aside out of the divisible profits of the Company for the half year ending on the 30th day of June last towards the redemption fund, in accordance with the provisions of the Company's Act of 1903, and

(2) That a dividend as follows for such half year be declared—viz.:

On the 4 per cent. consolidated preference stock, at the rate of £4 per cent. per annum.

On the convertible 5 per cent. preference stock, at the rate of £5 per cent. per annum.

On the 3½ per cent. maximum stock, at the rate of £3 10s. per cent. per annum.

On the ordinary stock, at the rate of £4 14s. 8d. per cent. per annum.

Subject to deduction of income-tax.

The GOVERNOR: I beg leave to move the adoption of the recommendations.

Mr. BURKE: I beg to second that.

The GOVERNOR: Before putting it to the meeting, I may say that the resolution will be a shorter one after this half year, because the "convertible 5 per cent. preference stock" has been dealt with under our Act, and will no longer appear.

The resolution was carried unanimously.

The GOVERNOR: I think I can go so far as to say that in the year coming the dividend will be an increasing one, and that consumers, co-partners, and shareholders will together rejoice in the alteration then to be made. That completes the business of to-day; and I thank you for your attendance.

VOTES OF THANKS.

Mr. F. H. PILLEY said the Governor had told them the business was concluded; and now he had the privilege of moving a very hearty vote of thanks to the Governor and Directors for the admirable way in which they had managed the affairs of the Company. They had not to look back many years when the meeting room used to be crowded, and they had an abundance of speakers. But, apparently, the confidence of the shareholders was now expressed by vacant seats. He knew it was customary for the Governor to record his sense of the labours of their officers, and he would not anticipate this; but he wanted to express, from his side of the table, his most hearty thanks to the Directors for their great energy and constant devotion to the interests of the Company. (Hear, hear.)

Mr. J. REESON had much pleasure in seconding the motion. It was most gratifying to him to hear such a resolution passed every half year, because it indicated the increasing prosperity of the Company.

The resolution was carried unanimously.

The GOVERNOR: Mr. Pilley, Mr. Reeson, ladies, and gentlemen—On behalf of my colleagues and myself, I thank you for this resolution. We always value it very much, and especially when we feel it has been earned. I have now the greatest pleasure in proposing that our best thanks be given to the officers and the workmen of the Company for their services during the past half year. From top to bottom, so far as I can judge, all are working cordially and heartily for the good of the Company; and the success which has been so far achieved is largely due to this fact. I beg to propose the resolution.

Mr. BURKE had very great pleasure in seconding it.

The resolution was carried unanimously.

Mr. D. MILNE WATSON (the General Manager): Mr. Chairman and gentlemen,—It is my duty and pleasure to reply on behalf of myself and fellow officers and workmen to the hearty vote of thanks which you have accorded to us. I have so often said how much we appreciate a vote of thanks half year by half year, that I may seem to repeat myself. But we do feel very deeply from our hearts, and we do appreciate very strongly, what you have so kindly said. No one appreciates more than do the officers and men the glorious success attained by the Company during the past half year.

Gas Cooking-Stoves as Cupboards at Warrington.—At the meeting of the Warrington Town Council last Tuesday, Alderman Pierpoint (the Chairman of the Gas Committee) said the Gas Engineer (Mr. W. S. Haddock) had reported that in many cases where prepayment cookers had been fixed they were not used. The Committee had therefore decided that all further cases of the supply of these cookers should be refused unless a minimum consumption of gas was paid for. He believed certain people in Warrington used the cookers as cupboards. It was only right that the Corporation should insist upon a minimum consumption of gas.

Grantham Water Company.—The seventy-fifth ordinary half-yearly meeting of this Company was held last Tuesday; Mr. J. G. Thompson presiding. The Directors laid before the shareholders the accounts for the six months ended June 30, which showed a balance upon the revenue account of £2813. They proposed that £2000 of this sum should be applied in the payment of a dividend at the rate of 5 per cent. per annum for the half year, and that the balance should be carried forward. The Chairman moved the adoption of the report, and said there had been an increase in the consumption of water during the past six months; but they had really met it without difficulty, and were able to look to the future without anxiety. The report was adopted.

Reduction in Price at Salford.—The Salford Town Council, at last Wednesday's meeting, confirmed recommendations of the Gas Committee that the price of gas should be reduced 2d. per 1000 cubic feet to ordinary consumers, and that the quantity of gas supplied for 1d. through prepayment meters should be increased from 27 to 30 cubic feet as soon as possible. The Mayor (Alderman Phillips), who is Chairman of the Gas Committee, explained that the recommendations were in fulfilment of a pledge he gave some time ago. The reduction to ordinary consumers takes effect as from the reading of the meters for the quarter ending the 30th prox. The present price of gas in Salford is 2s. 9d., with a discount of 4d. if paid within a month; and there is a graduated scale for users of large quantities.

SOUTH SUBURBAN GAS COMPANY.

The Half-Yearly Meeting of the Company was held last Friday, in the new Livesey Memorial Hall, Lower Sydenham—Mr. CHARLES HUNT in the chair. The holding of the meeting at the works was an nnovation; and the Directors and officials were highly gratified at the argeness of the attendance.

The ENGINEER (Mr. S. Y. Shoubridge), in the absence of the Secretary (Mr. Charles M. Ohren), through critical illness at home, read the notice convening the meeting; and the Directors' report and the statement of accounts [see *ante*, p. 310] were taken as read.

IN MEMORY.

The CHAIRMAN: In rising to move the adoption of the report and accounts, my first words must be of welcome to this building. It has been erected, I may say, by loving hands in memory of one whose great services, not alone to this Company, of which he was for so many years the Chairman, but to the whole gas industry, can never be forgotten; but whose chief claim to be remembered must always be his whole-hearted devotion to everything relating to the welfare of employees, and notably his establishment and consistent advocacy of co-partnership. Having determined upon this building as the form which our memorial to Sir George Livesey should take, it was not difficult to decide that it should be made as complete as possible, without undue expenditure, for the purpose for which it is intended; and proprietors will have full opportunity after the meeting of judging how far this intention has been carried out. They will, I am sure, join with the Directors in hoping that this Livesey Memorial Hall may long be a source of comfort and enjoyment to the employees of the South Suburban Gas Company.

BUSINESS EXPANSION.

It is, I hope, of happiest augury, on this occasion, that the accounts of which we have to ask your approval cover one of the best half years ever experienced by the Company. In the first place, there has been a gratifying improvement in the consumption of gas, as shown by the substantial increase of 3·65 per cent., exclusive of that which has been derived from the Festival of Empire Exhibition at the Crystal Palace. This increase, though somewhat discounted by the fact that it compares with a half year in which there was a slight decrease, is satisfactory, because under modern conditions it is increasingly difficult to secure additional consumption. The record of meters in use shows every half year an increase in the number of consumers; but the consumption per consumer is constantly growing smaller. This is partly due to the large and increasing proportion of small or prepayment meter consumers, and partly also to the economy of incandescent lighting, by which is obtained for the same consumption of gas from six to eight times the light of the old flat-flame burners. The effect of these changes is almost imperceptible from year to year; but it is apparent enough over a series of years. Thus since 1890, or twenty years ago, the total number of consumers on the books of the Company has risen from 11,789 to nearly 40,000; while in the same period the average consumption per consumer has dropped from 61,369 to 33,777 cubic feet. It is true that a larger number of small consumers is preferable to a small number of comparatively large ones, because greater stability is given to the business by the wider basis which numbers afford; and in this view the position of the Company has greatly improved during the last few years. For the increase of consumption, however, we rely largely upon heating and cooking appliances; and I am glad to say that the progress made with these continues to be very satisfactory. Mention is made in the report of the increasing proportion of cookers to meters in use; and to this may be added that whereas formerly cookers alone were applied for, it is now becoming quite usual for the householder to include one or two gas-fires, and perhaps a hot-water circulator, in his requirements. The prospects of the Company are distinctly encouraging in this respect, as shown by the progressive revenue derived from the hire of these appliances.

COMPANY'S WORK AT THE FESTIVAL OF EMPIRE EXHIBITION.

The figures given in the second paragraph of the report show that the consumption of gas has been materially assisted by the Festival of Empire Exhibition at the Crystal Palace, where, in addition to that which is used in connection with the special installations to which I will presently refer, a great deal of gas is being used by exhibitors for a variety of purposes, including lighting, heating, cooking, and motive power, the revenue from which for the current half year promises to be considerable. It was partly in anticipation of this supplementary consumption, as it may be called, and also in the hope that it might become more or less permanent through the renewed popularity of the Palace, that emboldened the Directors to make the bid which has enabled them to prove the possibilities of town gas as a source of power as well as of light on a far larger scale than has ever before been attempted, or perhaps called for. There is every reason, I think, to be satisfied with the result. Naturally, the lighting of the Palace and grounds with high-power gas-lamps forms a great attraction to the general public, and it has, I may say, called forth encomiums from all sides. The huge gas-engines, on the other hand, appeal very strongly to the initiated in such matters, for they are a triumph of mechanical skill. They mark a distinct advance in the construction of internal combustion engines, being, as stated in the report, the largest that have ever been worked from a town supply of illuminating gas. The makers, the National Gas-Engine Company, are to be heartily congratulated upon their notable achievement; and I may take this opportunity of acknowledging, on the part of the Directors, their effective co-operation, as also that of the James Keith and Blackman Company, who have carried out the lighting arrangements to the entire satisfaction of the Board. We desire also to record our appreciation of the services rendered in this connection by the Company's Chief Engineer, Mr. Shoubridge, and, as acting under his directions, their Chief Outdoor Superintendent, Mr. Baldry. Both have given unremitting attention to the very large amount of additional and onerous work which has devolved upon them; and they have been loyally supported by the veritable army of employees engaged in carrying out their instructions.

ADDITIONAL EXPENDITURE AND INCREASED RECEIPTS.

With regard to the accounts, the broad outstanding feature that cannot but engage attention is the fact that the Company are in the very fortunate position of having been able to meet somewhat large additional expenditure not only without diminution, but with an actual, though small, increase of the net profit available for dividend purposes. Works, mains, fittings, &c., all figure in the expenditure side for larger amounts than in previous half years; but I think I can say that in this respect high-water mark has for the present been reached, and that in the immediate future at any rate the amounts charged to repairs are likely to be somewhat less rather than more. The credit side of the accounts shows how this additional expenditure has been met. There is first of all a considerable increase in the receipts for gas, consequent upon the larger consumption; next, nearly £600 more in rents received for meters, stoves, &c.; and last, but by no means least, another all-round increase in the returns for residuals. Coke heads the list of these with no less than £3918. The value of this important residual showed for two or three months signs of slipping back, and at one time sales were made below last year's prices; but I am glad to say that a recovery has now set in. Much the same may be said of sulphate of ammonia, but with this difference, that prices for it have been uniformly higher than those of last year.

SULPHATE OF AMMONIA IMPROVEMENTS.

At our last half-yearly meeting, I spoke of the obligation we are under, in common with other makers of this material, to the Sulphate of Ammonia Committee for the propaganda work in which they have been for many years engaged. There can be no doubt that this has contributed to the improved position of affairs, as shown by the increase in the value of sulphate of £2 per ton on the average; and it would be less than grateful—in fact, unbusinesslike on our part—were we disposed to withhold any reasonable contribution that may be needed to the annual expense of spreading information as to the uses and properties of this very valuable fertilizer. The claim is made for it that, with proper use, crops can be obtained twice as great as the average for the United Kingdom, from which it would appear that its users are deserving of the famous commendation bestowed by the philosopher King of Brobdingnag upon "whoever could make two ears of corn, or two blades of grass, to grow upon a spot of ground where only one grew before." And in this commendation I am not sure that producers—to wit, the South Suburban Gas Company—are not entitled to share. At any rate, I am sure you will agree that Mr. Shoubridge and his assistants deserve well of this Company when I tell you that the increase during the last two years in the quantity of ammonia recovered per ton of coal carbonized represents an annual value to the Company, at present prices, of about £2000. Tar is the least important of the residuals, but it figures in the accounts for an additional £1150; and the latest prices are the highest that have been realized for many years. The remarkable improvement which has recently taken place in the value of this residual is almost entirely due to the increasing demand for it for road-making purposes.

THE NET RESULT.

The net result of the half-year's trading, after providing for payment of the bonus of 6½ per cent. under the co-partnership scheme, is £23,623, or about £1000 more than was earned in the corresponding half of last year. This will suffice for payment of the statutory dividends, leaving to be carried forward £2235 more than last half year.

REDUCTIONS—PRESENT AND PROSPECTIVE.

With regard to the future, it will have been gathered from the report that our coal is now costing less than it was last half year; and, in accordance with what has always been the settled policy of this Company, the price of gas has been reduced by 1d.—to 2s. 4d. per 1000 cubic feet. This is less than has ever before been charged for gas in the history of the Company; and the Directors hope it may be possible, should no unforeseen circumstances occur, to make a further reduction at no very distant date. In the meantime, the present reduction will entitle proprietors to an extra 3s. 4d. per cent. on the dividend, making this £5 16s. 8d. per cent. To the employees it means another ½ per cent. bonus, increasing it to 7 per cent.

GAS WORKERS AND THE NATIONAL INSURANCE SCHEME.

Coming now to the last paragraph of the report, in which reference is made to the National Insurance Bill, it may be desirable to point out in what way this Bill, as at present drafted, materially affects the interests of the Company's employees. This, let me say, is a workman's question, pure and simple; and the only object of the Directors is to do what they can on his behalf. There is already, as you know, a sick fund in connection with the works, the membership of which is voluntary, but which embraces practically all the workmen—the benefits being guaranteed by the Company. This fund was established as far back as the year 1880; so that in support of the present position there is an experience of 31 years to appeal to. It is nominally under the management of the Company; but the Co-partnership Committee are from time to time consulted with regard to it. Without going too much into detail, it may be sufficient to say that for a contribution of 3d. per week, the workman is provided with medical attendance and medicine; and in case of sickness, 12s. per week sick benefit for the first thirteen weeks, and 6s. per week for the second thirteen weeks. The average cost of administering the fund, exclusive of book-keeping and stationery provided by the Company, but inclusive of sick visitor, has for the last five years—namely, from 1906 to 1910 inclusive—been 4·70d. per week per man. Of this sum, the workman's share has been 2·99d., and the Company's share 1·71d. The details are here for each year, if anyone would like to have a copy. In comparison with this, the Bill before Parliament provides that the contribution of each workman shall be 4d. per week, and that there shall be a contribution from the employer of 3d. and from the State of 2d. per week per man. This makes 9d. per week in all, as compared with 4·70d. the cost of maintaining the Company's sick fund. The benefits to be secured to the workmen are medical attendance and medicine, 10s. per week in case of sickness for the first thirteen weeks, and 5s. per week for the second thirteen weeks—being 2s. and 1s. per week less than he now obtains for the smaller contribution of 3d., to say nothing of the proposed increase in

Workmen's Sick Fund.

Year.	No. of Members.	Annual Contributions. Company.	Annual Contributions. Members.	Average. Per Member. Per Week. Company.	Average. Per Member. Per Week. Members.	Total Cost per Week.
		£ s. d.	£ s. d.	d.	d	d.
1906	515	191 19 7	349 2 9	1·72	3·10	4·82
1907	488	178 14 7	324 2 9	1·69	3 05	4·74
1908	508	232 11 6	332 7 9	2·10	3 02	5·12
1909	547	209 16 4	329 18 9	1·77	2·80	4·57
1910	542	152 0 6	350 6 0	1·29	3·00	4·29
				8·57	14·97	23·54
Average for five years				1·71	2·99	4·70

the employer's contribution and that of 2d. by the State. It must be said, however, that additional benefits are provided by the Bill, in the shape of maternity allowance and sanatorium benefit; and there is also what is called "disablement" benefit, which in the case of this Company is already to a great extent met by the superannuation fund. All these combined do not, however, anything like make up the difference between the present cost of 4·70d. per week per man and the 9d. proposed by the Bill. The subject has been very carefully considered by the Co-Partnership Committee; and, so far as can be gathered, there is no objection at all, on the part of the workmen, to the increase of contribution from 3d. to 4d., and there is certainly no objection on the part of the Company to paying 3d. per week per man instead of about 1¾d. But there is a very natural desire that benefits shall be secured proportionate to these increased payments, instead of the benefits being actually reduced as proposed by the Bill. As it is clearly the object of the Chancellor of the Exchequer to work through existing agencies, such as the various friendly societies, and this sick fund has proved itself to be a very efficient, as well as an economically managed, agency, there is surely no reason why it should not be approved as such, and left to manage its own affairs and administer its own funds. All that is asked for is autonomy for this and similar funds, either by recognition as "approved" societies, or by exemption of such funds in connection with statutory companies, under the first schedule of the Bill, as is already conditionally provided for in the case of employment under the Crown or "any local or other public authority." If proprietors can assist the employees in this direction, by bringing pressure to bear in any quarter in which they may have an interest, they will be doing a service to them. I may say that deputations from the workmen have already interviewed various members of Parliament on the subject, and have received many promises of support; while our colleague Sir Fortescue Flannery is actively interesting himself in his place in Parliament in securing the necessary amendments. It is said objection may be taken to this and similar funds on the ground that they have not received the formal sanction of the proprietors, are not registered under the Friendly Societies Acts, and that no actuarial valuations have been made of their liabilities. Such objections are surely puerile in the face of accomplished facts; and I need hardly say they can easily be met. Our own fund has been tacitly, if not formally, approved by you for the last 31 years; and your formal approval can, we are sure, be had for the asking. With regard to registration, the Directors have no wish to stand in the way of any regulation that may make the position of the contributors more assured, although it is not easy to see how this may be possible. Actuarial valuations can only be necessary in the event of fixed contributions from the Company being adopted, since the expenses of administering the fund show no increase during recent years; and whatever may be the deficiency, it will continue to be borne by the Company so long as the fund exists on its present footing. This, I think, completes the remarks I desired to make; and I now beg leave to move the adoption of the report and accounts.

Mr. Robert Morton seconded the motion, which was unanimously carried.

The Deputy-Chairman (Mr. Jabez Light) proposed the declaration of a dividend at the rate per annum of 5 per cent. on the preference stock, and 5⅔ per cent. on the ordinary stock, less income-tax. He remarked that the half-year's working had been most satisfactory in every respect. There was not one single unsatisfactory feature. Summed up in few words, they had had a larger consumption of gas, and at the same time higher prices for residuals. These two items almost explained their position. The 1d. reduction in the price of gas that they were making would mean about £3000 to the benefit of the consumer in the current half year.

Mr. W. G. Waller (one of the Workmen-Directors) seconded the motion. In doing so, he said he must take the opportunity, on behalf of the employees, of thanking the proprietors for building the magnificent hall in which they were assembled, and for placing it at their disposal for recreation. For many years past, it had been found that the existing recreation room was quite inadequate for the purposes for which it was required. Therefore, this fact alone made the hall the more acceptable.

Mr. H. Gundry, in proposing a vote of thanks to the Chairman and Directors, remarked that they owed a debt of gratitude for the able way in which they conducted the affairs of the Company. He should like to congratulate them upon the happy thought that resulted in the holding of the meeting at Lower Sydenham, as this enabled them to see the new and magnificent hall, and how the dividends were earned. It would be of the greatest interest to the proprietors to inspect the works. He desired to include the staff in the resolution.

Mr. T. P. Hill seconded the motion; and it was very heartily carried.

The Chairman, acknowledging the vote on behalf of himself and his colleagues, remarked that it gave them very real pleasure to have such a large audience that day. The Board were in fear and trembling lest the departure from the customary practice of holding the meeting in London should result in a smaller attendance than usual. On the contrary, it had been so successful that he thought it would encourage the Directors to repeat the experiment. With regard to the vote of thanks to the Engineer, the Secretary, and the staff generally, it had usually been the Chairman's privilege to propose it. But Mr. Gundry had included it in the resolution he had moved; and he (the Chairman) need not say how heartily the Board concurred in what had been said in appreciation of the services of the officers.

Mr. Shoubridge (called upon by the Chairman) thanked the proprietors for their kind vote of thanks. The officers and employees generally really felt that the Directors and proprietors were a great deal too good to them. Not only did they give them a bonus every year, but they had this year provided them with the excellent building in which they were meeting, and for it they could not be thankful enough. They would all try in the future to show they heartily appreciated the kindness and considerate treatment shown to them.

THE WORKS OF THE SOUTH SUBURBAN GAS COMPANY.

Notes Obtained During an Inspection by Proprietors.

The proprietors of the South Suburban Gas Company, at the close of their meeting last Friday, inspected the works at Lower Sydenham under the personal guidance of the Engineer (Mr. S. Y. Shoubridge), his chief assistant (Mr. John Whimster), and other members of the staff. The Chairman (Mr. Charles Hunt) and other Directors also accompanied the large and interested party.

It is a long time since information concerning the works was published; and therefore it may be of interest to run lightly over the principal features. The works were built in 1854; and the area covered by them is 45 acres. The district of supply extends to 15 square miles. The number of men employed on the works is 380; and on the district 220—total 600. The number of ordinary consumers is 21,000; of prepayment consumers, 18,800; of cookers in use, 27,900; of meters, 39,800; and of fires, &c., 5800. The total manufacturing capacity of the works per 24 hours is: Coal gas, 11 million cubic feet (920 tons of coal); and carburetted water gas, 2 million cubic feet—total, 13 million cubic feet. The quantity of coal carbonized last year was 120,000 tons; gas produced, 1,450,000,000 cubic feet; coke, 70,000 tons; tar, 1,150,000 gallons; and liquor, 3,650,000 gallons. The total storage capacity of the gasholders is 8¼ million cubic feet; and boosters are used for increasing the pressure in the mains.

Regarding the carbonizing plant, No. 1 retort-house has a capacity of 1,100,000 cubic feet per twenty-four hours. The house contains 70 retorts on the inclined system, tapering from 24 in. by 16 in. to 21 in. by 16 in. by 20 ft. long, in ten beds of sevens, heated on the regenerative principle. No. 2 retort-house has found other employment. No. 3 retort-house has a capacity of 4,600,000 cubic feet per twenty-four hours. It contains 260 retorts, on the horizontal system, 22 in. by 16 in. by 22 ft. long, in twenty-six beds of tens. The retorts are charged and discharged by De Brouwer machinery, worked by electricity generated by gas-engines and dynamos. The coke is removed by an endless chain of the De Brouwer type. The coal is received in railway waggons, which are mechanically emptied into an elevator, which raises it into hoppers for feeding the charging-machine. No. 4 retort-house has a capacity of 2,300,000 cubic feet per twenty-four hours. It contains 144 retorts on the horizontal system, 21 in. by 15 in. by 20 ft. long, in eighteen beds of eights. The retorts are charged and discharged by West's machinery driven by compressed air. The coke is removed in a similar manner to that in No. 3 house. No. 5 retort-house has a capacity of 3,000,000 cubic feet per day. It contains 186 retorts, on the horizontal system, 22 in. by 16 in. by 20 ft. long. These retorts like those in No. 3 house are charged and discharged by De Brouwer machinery; but in this case the power used is compressed air, instead of electricity, and is supplied by air-compressors situated in the exhauster-house. The coke is removed from the house as in No. 3 house, by a De Brouwer conveyor; but this house is fitted with additional plant for putting coke direct into railway waggons.

There are two sets of carburetted water-gas plant, each of 1 million cubic feet per day capacity, together with exhausters and blowers. Adjoining this building is the boiler-house, containing four steam boilers, 8 ft. diameter by 30 ft. long, which supply all the steam used in the works. At the back of the carburetted water-gas building is a set of five purifiers, 40 ft. by 22 ft. by 5 ft. deep, for purifying the carburetted water gas.

The exhauster-house (which is a handsome building) contains two sets of exhausters of 300,000 cubic feet capacity per hour, and one set of 250,000 cubic feet capacity per hour. Also situated here are two air-compressors, for supplying the power to the retort-house machinery in Nos. 4 and 5 retort-houses.

An interesting feature is the water supply provided for domestic and other purposes on the works. It is obtained from an artesian well of a depth of 257 feet; the water being pumped into a tank at the top of a fine water-tower, which is 85 feet above ground-level.

The condensers, washers and scrubbers, purifiers, station meters, and mechanics' shops were also inspected. Then in the meter-repairing shop, it was found that thirty men are employed; the number of meters repaired per annum being about 6000. In the stove-repairing shop, 24 men find occupation; the number of stoves and fires repaired per annum being about 11,000.

A further feature of the works is the plant for the manufacture of fire-bricks. By it the whole of the fire-bricks used on the works are made by the Company's own men; and by doing so, it is stated that a saving of upwards of 40 per cent. is effected in the cost. The visitors were highly interested in seeing how the disused retort material is again brought into service in the making of new material.

Three locomotives find occupation on the works for shunting the coal and coke trucks.

BRENTFORD GAS COMPANY.

The Half-Yearly Meeting of the Company was held on Wednesday last, at St. Ermin's Hotel, Caxton Street, S.W.—Mr. ULICK J. BURKE in the chair.

The SECRETARY (Mr. William Mann) read the notice convening the meeting; and afterwards the Directors' report and the statement of accounts were taken as read.

A HIGHLY SATISFACTORY POSITION.

The CHAIRMAN, in moving their adoption, said he should like to call attention especially to two very noteworthy and satisfactory statements in the report—the one referring to the expansion of business in every department, and the other in the opening statement as to an amount of £124,081 being available for dividend. Here they had practically, in few words, the history of the undertaking during the half year ending June last; and the results, he thought the proprietors would agree with him, were highly satisfactory. It had been the custom to, at the meetings, enter as closely as was desirable into the details of the accounts in comparison with the corresponding period of the preceding year, in order to bring to notice any variation there might be. But, after looking carefully through the present accounts, he found very few points that called for special comment or explanation. The work had been carried on with consistent energy and attention, and had resulted in a steady development in output, with a reduction in the general cost of manufacture, in spite of such development. In other words, put into figures, they had during the half year sold 70 million cubic feet more gas, at £570 less cost for manufacturing wages. He thought it would be agreed that this was eminently satisfactory; and that it was a position of which their General Manager and Engineer (Mr. A. A. Johnston) and his officers might very justly feel proud. He (the Chairman) could only say they had earned the hearty thanks of the Board by the assiduity and attention that had brought this about.

A GOOD RESIDUALS HALF YEAR.

Then, turning to the accounts, the most noticeable difference found among the few differences there were to refer to occurred in the item of residuals. It was very satisfactory, for instance, to find that coke had brought in as much as £4000 more than in the corresponding period of last year; and he thought that this was satisfactory in one special way, because it showed that coke was finding more and more its position as a heating agent generally—in the household and elsewhere. In addition to the £4000 increase in coke, as much as £1700 more was obtained from ammoniacal liquor. This might be taken to be due a good deal to the greater return from sulphate of ammonia.

RECONSTRUCTIONS AND EXTENSIONS.

Then, on the other side of the accounts, it was seen that distribution charges had been less by as much as £7437, under the heading of repairs and maintenance of mains. This £7437 very largely represented expenditure incurred through a long period of reconstruction work. He (the Chairman) warned the proprietors that they would have to go through this, and they did go through it, until they came to the final payment for the 30-inch main from Brentford to Southall, which had been in hand for some time, and which was now completed and paid for. Then under the same heading would be noticed a reduction of £2800 in the cost of repairs and renewals of meters and stoves. This was due to depreciation being calculated on a more approved basis, which, in the opinion of the Directors, quite adequately dealt with the stock in this respect. This was practically the history of the concern in the past half year.

FURTHER REDUCTION IN PRICE.

Then he wanted specially to turn attention to the paragraph in the report which said: "The continued expansion of business in every department gives the Directors great satisfaction. They regard it as very encouraging, and feel that it justifies a further reduction of 2d. per 1000 cubic feet in the price of gas, which they propose shall take place as from Michaelmas next." A statement of this kind in the report of a board of directors of a gas company was one of the most satisfactory items they could mention. It was indicative not only of progress, but also of stability. He regarded it as the first policy of a gas company to reduce the price of gas as much as possible. It must in this relation be remembered that there were two points to consider. One was that they had already recently had a reduction which made the price 2s. 7d. instead of 2s. 9d. per 1000 cubic feet; and there was another point.

DAYLIGHT CONSUMPTION—THE LADY DEMONSTRATOR.

They happened to know that the increase in consumption was largely contributed to by the Sunday consumption for cooking. This Sunday consumption to-day bore a larger proportion in the output of gas than it used to do. This was the daylight consumption; and, being so, it represented a certain economy in capital, seeing that capital that would otherwise be lying idle during the daylight hours was being employed. It also showed the greater development of the consumption of gas on the heating and cooking side of the business. This was a branch it behoved gas companies to develop as much as possible. In this connection, he should like to acknowledge the assistance that the Company had received from their lady demonstrator—Miss Royle—and her assistant. Perhaps they were apt to overlook the advantages they derived from their help. Their work encouraged cooking and heating by gas in an intelligent form. The amount of ignorance that existed in connection with both cooking and heating they found was very great; and these ladies, through the exercise of considerable patience and tact, had been enormously useful in developing this branch of the business. He was sure the proprietors would be glad to recognize the advantage so derived.

THE GREATER LONDON RAILWAY BILL.

Then he came to the opposition the Company had to offer to the Greater London Railway Bill. It would be recollected that in February last, he warned the proprietors that there was a cloud hanging over the undertaking in the shape of the Greater London Railway Bill. He could not tell the proprietors adequately how important the action of the Bill was to them. The promoters proposed to go right through their works—to carry their line right across the land the Company had at Southall which was scheduled for manufacturing purposes, and therefore to cut off the land resources of the Company for future development. To him, and he was sure to other people, it was perfectly marvellous, after the experience of 1906, that the promoters of this railway scheme should have proposed to go on with this particular part of their project. They must have realized that this was statutory land granted to the Company in 1881, after a careful and expensive inquiry, not only for their then present use, but for future development. But after that, these promoters again came to them this year in very much the same easy, semi-ignorant way, and proposed the very same thing. The Company had to oppose the Bill as in 1906; and they were successful in this. But the Board could not help feeling that it was rather unfair to the Company. For promoters of a railway scheme to rush on to statutory land like this was very much like having a bull in a china shop. In 1906, the "bull" broke a considerable amount of china for which he did not pay. Very much the same amount of breakage had been done on this occasion; and yet they did not get a shilling of the cost they had incurred. But they had turned the bull out, and that was the best thing of all.

Mr. R. J. N. NEVILLE, M.P., in seconding the motion, remarked that the Chairman had not fully alluded to the fact that it had been decided to reduce the price of gas by 2d. from the ensuing Michaelmas. The Chairman had pointed out that there had been a reduction in the price by 2d. within the past twelve months; and within a few months after the twelve months, there would have been a reduction of 4d. This was the best possible criterion of the success of the Company. It was their object to reduce the price of gas, because they obtained more customers; and if they were successful in this, it tended to increase the dividend—that was to say, as the price of gas went down, the dividends went up. The number of the Company's consumers was largely increasing, and so was the revenue. The gift to the consumers of 4d. within a few weeks of twelve months was a large one indeed. It amounted, he believed, to the sum required for a half-year's dividend; so that this showed the Company were going on by leaps and bounds. Of this they could not possibly have a better indication than the fact that they were able to reduce the price of gas. The Chairman had alluded to the fact that they were doing extra business at less cost. The capital employed per ton of coal carbonized was being reduced in consequence of the larger usage of gas. The result of the past year's working was that the capital per ton of coal had gone down by something like 3s. 2d. He thought they must congratulate themselves and their officers upon the splendid returns for the half year.

The motion was carried unanimously.

On the proposition of the CHAIRMAN, seconded by Mr. NEVILLE, a dividend was declared for the half year at the rate per annum of 5 per cent. on the 5 per cent. preference stock, at the rate of 13 per cent. on the consolidated stock, and at the rate of 10 per cent. on the new 1881 stock, all subject to income-tax.

Proposed by Mr. DEAR, and seconded by Mr. FINNIS, a hearty vote of thanks was passed to the Chairman and Directors, and the officers and staff of the Company.

The CHAIRMAN, in the course of his acknowledgments, remarked that he hoped the consumers would, for a time at all events, be satisfied with the price of 2s. 5d. per 1000 cubic feet of gas.

COMMERCIAL GAS COMPANY.

The Half-Yearly Report and Accounts.

The following is the report for the six months ended June 30 last which the Directors of the Commercial Gas Company will present at the half-yearly meeting on Thursday.

The revenue account shows a net profit for the half year of £66,587 5s. 4d., which, added to the balance of £52,032 7s. 4d. brought forward, produces a net revenue balance of £118,619 12s. 8d. Deducting therefrom £8504 6s. 4d. for interest, there remains standing to the credit of the net revenue account a balance of £110,115 6s. 4d. available for dividend. The Directors recommend the payment of dividends at the rates of £5 9s. 4d. per cent. per annum on the 4 per cent. stock of the Company, and of £5 6s. 8d. per cent. per annum upon the 3½ per cent. stock, both less income-tax. The balance of the net revenue will be carried forward to the next half year.

Mr. Hubert Dynes Ellis has resigned his position as Secretary of the Company; and the Directors have appointed the Accountant, Mr. Frederick John Bradfield, in his stead. A resolution will be submitted to the proprietors to determine the amount of Mr. Bradfield's remuneration. The Directors announce with much regret the death of their esteemed colleague Mr. John Giles Pilcher, who was for twenty years a Director of the Company. In conformity with the Acts of Parliament regulating the Company, they have elected Mr. Hubert Dynes Ellis to the seat on the Board thus vacated.

The accounts accompanying the report consist of the usual set of statements. They show that the paid-up stock on the 30th of June amounted to £996,405; that £1,076,875 had been added by conversion, making £2,073,280; and that £149,298 remained unissued out of the total authorized capital (including premiums) of £2,235,000. The total amount borrowed on the above-named date was £339,062 10s., and £135,937 10s. was added by conversion; making a total of £475,000, and leaving £79,226 to be borrowed, out of the £550,000 authorized. Capital account receipts amount, with premiums, to £2,606,065 4s. 5d. The expenditure stands at £1,450,370 8s. 5d., with a nominal amount of £1,212,812 10s. added by conversion—together, £2,663,182 18s. 5d. There is consequently a balance of £57,117 14s. carried to the balance-sheet. A sum of £1134 was expended during the half year on new and additional mains, services, &c.; but as £736 is credited for meters, stoves, prepayment meters, and fittings, the net expenditure stands at

£398. The reserve fund amounted at the close of the half year to £36,312; and the insurance fund to £32,538. The following is the

REVENUE ACCOUNT.

Expenditure.

Manufacture of gas—		
Coal and oil, including dues, carriage, unloading, and trimming	£88,161 5 1	
Salaries of Engineer and officers at works	2,897 18 8	
Wages (carbonizing)	10,142 12 0	
Purification, including labour	1,875 17 5	
Repair and maintenance of works and plant, materials and labour (less £327 11s. 6d. received for old materials)	34,338 17 10	
		£137,416 11 0
Profit sharing		3,370 15 10
Distribution of gas—		
Salaries and wages of officers (including rental clerks)	£4,862 13 1	
Repair, maintenance, and renewal of mains and services, material and labour	7,170 3 10	
Repair and renewal of meters	2,334 8 4	
" " " " stoves	10,176 6 2	
" " " " prepayment meters and fittings	11,164 5 8	
Incandescent mantle maintenance	687 6 10	
		36,395 3 11
Public lamps—lighting and repairing		2,396 9 4
Rent, rates, and taxes		14,577 10 7
Management—		
Directors' allowance	£1,250 0 0	
Company's Auditors	75 0 0	
Salaries of Secretary, Accountant, and clerks	1,281 17 3	
Collectors' salaries and commission	1,697 10 4	
Prepayment meter collection	3,175 3 0	
Stationery and printing	1,008 6 4	
General charges	2,014 0 11	
		10,501 17 10
Bad debts		516 19 7
Law and parliamentary charges		201 4 8
Superannuations and allowances		1,5 8 13 9
Official officers, &c.		138 9 11
Total expenditure		£207,033 16 5
Balance carried to net revenue account		66,587 5 4
		£273,621 1 9

Receipts.

Sale of gas—		
Per meter (No. in use, 105,191) at 2s. 4d. per 1000 cubic feet	£187,219 12 4	
Public lighting and under contracts	5,655 7 3	
	£192,874 19 7	
Less discounts and allowances	4,372 19 6	
		£188,502 0 1
Rental—		
Meters (23,733)	£2,8 7 13 2	
Stoves (64,813)	10,370 1 7	
Prepayment meters and fittings (80,697)	14,269 0 3	
Incandescent mantle maintenance	694 18 8	
		28,171 13 8
Residual products—		
Coke, less £4176 19s. 2d. for labour	£35,341 15 6	
Breeze, less £928 0s. 11d. for labour	1,652 13 0	
Tar	7,912 17 7	
Ammoniacal liquor and sulphate of ammonia	11,950 2 5	
		56,869 8 6
Miscellaneous receipts—		
Rent receivable	£30 19 6	
Transfer fees	47 0 0	
		77 19 6
Total receipts		£273,621 1 9

The following are the statements relating to the manufacturing operations of the Company in the half year:—

Statement of Coal and Oil.

—	In Store Dec. 31, 1910.	Received During Half Year.	Carbonized During Half Year.	Used and Sold During Half Year.	In Store June 30, 1911.
	Tons.	Tons.	Tons.	Tons.	Tons.
Coal	22,020	93,281	94,209	716	20,376
Oil—gallons	530,282	1,523,583	1,390,411	..	663,454

Statement of Residual Products.

Description.	In Store Dec. 31, 1910.	Made During Half Year.	Used During Half Year.	Sold During Half Year.	In Store June 30, 1911.
Coke—tons	4,183	58,881	8,792	52,866	1,405
Breeze—tons	3,066	9,465	..	10,283	2,248
Tar—gallons	516,474	1,111,672	..	1,211,948	416,198
Ammoniacal liquor—butts of 108 gallons	9,234	34,218	38,749	..	4,703
Sulphate of ammonia—tons	50	1,230	..	1,250	30

Statement of Gas Made, Sold, &c.

Quantity Made.	Quantity Sold.		Quantity Accounted for.	Number of Public Lights.
	Public Lights and under Contracts (estimated).	Private Lights, per Meter.		
Thousands.	Thousands.	Thousands.	Thousands.	
1,764,178	36,579	1,606,260	1,669,301	3894

The remaining statement is the balance-sheet, which gives the value of the stores in hand at the close of the half year as follows: Coal, oil, &c., £20,007; coke and breeze, £1144; tar, ammoniacal liquor, sulphate of ammonia, &c., £6584; sundry stores, £30,923—total, £58,658. The figures this time last year were: Coal, oil, &c., £20,521; coke and breeze, £1665; tar, ammoniacal liquor, sulphate of ammonia, &c., £7505; sundry stores, £32,866—total, £62,557. A sum of £20,370 stands in the balance-sheet as employees' bonus and savings, compared with £16,073 at the end of June, 1910.

BROMLEY AND CRAYS GAS COMPANY.

An Appreciation of the Late Secretary.

The Half-Yearly General Meeting of this Company was held last Thursday—Mr. ALEXANDER DICKSON (the Chairman) presiding.

The accounts presented showed that the revenue in the six months ended June 30 was £43,502, and the expenditure £32,772; leaving £10,730 to go to the profit and loss account. The balance applicable for distribution was £12,117; and the Directors recommended the declaration of dividends, under the sliding-scale, at the rates of 6, 4½, and 5¼ per cent. per annnum on the "A," "B," and "C" stocks respectively, subject to income-tax. The payment of these would absorb £9261, and leave £2856 to be carried forward. The working statements show that, under the supervision of Mr. W. Woodward, the Company's Chief Engineer, 14,826 tons of coal were carbonized in the half year in the production of 218,264,000 cubic feet of gas, of which 201,952,000 cubic feet were sold; and that the residual products were: Coke, 8895 tons; breeze, 89 tons; tar, 174,022 gallons; sulphate of ammonia, 143 tons. The Directors reported that the business of the Company continued to show satisfactory progress.

The CHAIRMAN, in moving the adoption of the report, said he took it that its brevity would be entirely satisfactory to the shareholders. The Directors had nothing sensational to report. The accounts showed both advantages and disadvantages; and when the figures were adjusted, the disadvantage was about £190. Of the increased expenditure, £800 arose from the higher price of coal. There had disappeared from the accounts the remainder of the sum which was last year standing as an undischarged liability in connection with the account for the substitution of plant at Bromley for the works of the amalgamated Company; so that they were quite clear of further liability in this respect. The business of the Company had been most satisfactorily strengthened by amalgamation. Referring to the late Secretary (Mr. H. W. Amos), the Chairman said that the shareholders had, no doubt, all heard of his death since the issue of the report. Mr. Amos entered the Company's service 48 years ago, and his qualities secured for him first the appointment to the post of collector, and subsequently to that of Accountant and Secretary; and the last office he held for some twenty years. His work was always done to the best of his ability, and with that integrity of purpose which testified to a high life and long and honourable record. He would always be remembered as one of the Company's most faithful and loyal officers. The Directors expressed their sympathy with Mrs. Amos and family.

The DEPUTY-CHAIRMAN (Colonel Bertram H. Latter) seconded the motion; and it was carried.

The dividends recommended having been declared,

The CHAIRMAN moved the following resolution: "That the Bromley and Crays Gas Company, in general meeting assembled, hereby records its sense of the loss which the Company has sustained in the sudden death of its Secretary, Mr. H. W. Amos, and its appreciation of his services, which, in different capacities, extended over a period of 48 years; and that a copy of the foregoing resolution be forwarded to Mrs. Amos, with an expression of sincere sympathy with herself and family."

Two of the shareholders having joined with the Chairman in his tribute of praise to the late Secretary, the resolution was agreed to.

The CHAIRMAN said the Directors had been much touched by the suddenness with which the death of Mr. Amos had come about; and they had resolved to recommend that a sum of one hundred guineas should be paid to Mrs. Amos. He therefore proposed that this amount should be voted to the widow of the late Secretary, in view of the very sudden termination of his career.

The proposition was agreed to.

The CHAIRMAN, in responding to a vote of thanks accorded to him, said the Directors invariably saw eye to eye in matters affecting the progress of the Company, which was, of course, added to by the officers and staff carrying out the policy and directions of the Board. It was always a pleasure on such occasions to acknowledge the work of the Chief Engineer (Mr. Woodward), for his painstaking efforts in connection with all that conduced to the advantage of the Company, and those who assisted him; also that of the Chief Clerk (Mr. Wicks) and others in the Secretary's office. They much appreciated their services.

Halifax and the Bailiffe Bridge Gas Supply.—At the meeting of the Halifax Town Council last Wednesday, the Gas Committee reported the receipt of a letter from the Clerk to the Hipperholme District Council, stating that his Council were prepared to acquire the undertaking of the Bailiffe Bridge Gas Company, Limited, and to supply gas. He asked whether it might be understood that the Corporation would not dissent to a Provisional Order, if applied for, empowering the Council to work the undertaking, and also inquiring on what terms the Corporation would be prepared to sell to the Council gas in bulk for distribution at Bailiffe Bridge. After hearing the Town Clerk's report upon the whole question, the Committee resolved that he should reply "that the Committee cannot recommend the Corporation to give an undertaking not to oppose an application made by the Council for a Provisional Order, as suggested; and that, so far as regards the portion of the area now being supplied by the Bailiffe Bridge Gas Company which is in the Halifax area of supply, the Committee would, if necessity arose, themselves supply such portion if the Bailiffe Bridge Gas Company ceased to supply there.

WELSBACH LIGHT COMPANY, LIMITED.

Statutory Meeting.

There was not a very numerous gathering at the statutory meeting of the Welsbach Light Company, Limited (which was held at Winchester House, E.C., last Tuesday); but nevertheless the proceedings were of quite a lively character, owing to the attitude of one or two shareholders.

The Secretary (Mr. S. J. Endersby) read the notice convening the meeting and the certificate of Messrs. Deloitte, Plender, Griffiths, and Co., the Auditors. It was set forth in the statutory report that the total number of shares allotted was 262,000, of which 162,000 were allotted as fully paid up. The total amount of cash received by the Company in respect of the shares issued wholly for cash is £100,000. The preliminary expenses are estimated at £7000. The following is the constitution of the new Board: Herr Felix Kallmann, of Berlin (Chairman), Sir Edwin Grant-Burls, Kt., C.S I. (Vice-Chairman), Mr. C. M. Crompton-Roberts, Herr R. Feuer, of Berlin, Mr. L. Fletcher, Mr. E. Lovinson, and Major G. O. S. Pringle.

The meeting was presided over by Sir Edwin Grant-Burls, who pointed out that this was not an ordinary annual meeting of the Company. There was no Directors' report, no balance-sheet, and no resolution to put. It was merely a meeting required by Statute to be held for certain limited purposes, and within a limited period from the date at which the Company were entitled to commence business. The statutory report, which was in the hands of the shareholders, contained all the information required by Parliament to be submitted to them.

At this point, several shareholders exclaimed "No, no;" and Mr. Green, interrupting, said that he and others were going to ask the Board of Trade to hold an inquiry into the conduct of this business. They had no fault to find with the gentleman now presiding; but they did contend that Major Pringle, Mr. Crompton-Roberts, and Mr. Fletcher had no right to sit on the Board—they did not represent the shareholders. It was proposed to ask the Board of Trade to hold an inquiry from the very beginning. They said the United States Debenture Corporation had no earthly right to nominate two Directors.

Remarking that this had nothing whatever to do with the business before the meeting, the Chairman continued his speech. He said the shareholders were aware that the Company had been formed as the result of an agreement entered into on Jan. 30 last between the Deutsche Gasgluhlicht Aktiengesellschaft (Auergesellschaft)—or the German Company—and the old Welsbach Incandescent Gaslight Company, Limited, which subsequently went into liquidation. Under the agreement, the German Company undertook to form a new Company with a capital of £265,000 in £1 shares, and to procure the new Company to enter into an agreement for the purchase of all the assets of the old Company. The purchase price was to be £100,000 in cash, £240,000 in debenture stock of the new Company, and £100,000 in fully-paid shares. The new Company were also to undertake other responsibilities, with which he need not trouble the shareholders. The transaction foreshadowed by this preliminary agreement was, after lengthy discussion and due consideration of the many points involved, and of the documents necessary to carry the matter out, both in Berlin and London, duly proceeded with. The Memorandum and Articles of Association of the new Company having been eventually agreed and approved by all parties, registration of the Company took place on May 6 last; and on May 15, the definite sale agreement between the old Company and their Liquidator, the German Company, and the new Company was entered into. In accordance with their obligations, the German Company subscribed in cash for 100,000 shares of the new Company, so as to provide the cash portion of the purchase consideration for distribution among the preference shareholders of the old Company. A debenture stock trust deed, dated May 31, had been entered into to secure the £240,000 worth of debenture stock; the parties to this deed being the new Company, the German Company (as guarantors), and the United States Debenture Corporation, Limited (as Trustees). Then 35,000 fully-paid shares were allotted to the German Company or their nominees, in consideration of the guaranteeing of the payment of principal and interest of the debenture stock and provision of sinking fund; and 30,000 fully-paid shares were allotted to them, or their nominees, in consideration of subscribing at par 100,000 shares of £1 each. The question of the liquidation of the old Company had really nothing to do with this meeting; but as the point had been more or less indirectly raised, and as the shareholders might be anxious to know the apparent reason for the delay in the completion of the matter (for which the present Directors were not in any way responsible, as they had nothing whatever to do with the liquidation of the old Company), he might say that the mass of detail to be got through had been enormous, and that the Liquidator and the clerical staff at the Company's offices had for many weeks past been working until late at night. With regard to the constitution of the Board, he did not know the past history; but two of the Directors were, in pursuance of the agreements, nominated by the Trustees of the debenture holders. They were Major Pringle and Mr. Crompton-Roberts. Some of the Board—like himself—were associated with the conduct of the business for the first time. On the other hand, continuity was assured from the fact that some of the members of the Board had been previously connected with the business. "But at any rate," he concluded, amid disturbance, "whether with or without continuity, you may rely upon the present Board to do their best in your interests to carry this business to a big success."

Mr. Green then heatedly returned to his objection to the Directors he had already named. Mr. Fletcher, in reply, said that he, Major Pringle, and Mr. Crompton Roberts joined the Board only after the Advisory Committee had gone through the past affairs of the Company, in the hope that it might be possible to pull the Company together; and since then practically the whole of the actual capital had been repaid in dividends, and the Company had been sold for a figure in excess of its value at the time he joined the Company. He did not at all want to take the job on; but the German Company had insisted upon him entering into an agreement with the new Company. He had a duty to the shareholders; and he would carry it out. Colonel Ranken then took up the opposition, on similar lines to Mr. Green, and moved a resolution to the effect that the shareholders refuse to confirm the appointment of the three Directors named; but the Chairman ruled this out of order.

The proceedings, which had lasted upwards of half-an-hour, terminated with a vote of thanks to the Chairman.

NEWPORT (MON.) GAS COMPANY.

The Half-Yearly General Meeting of this Company was held last Tuesday—Dr. H. M. Brewer (the Chairman) presiding.

The Secretary (Mr. T. H. Hazell) having read the notice convening the meeting, the report of the Directors, with the accounts for the six months ended the 30th of June, was presented. The accounts showed a sum of £10,718 available for distribution; and the Directors recommended the payment of the statutory dividends.

The Chairman, in moving the adoption of the report, referred to the recent reduction of 2d. per 1000 cubic feet in the price of gas, and said there had been a satisfactory increase in the sales during the half year. The Board had given effect to the long-standing desire to reduce the price; and their action had been justified. If the increase in business continued satisfactory, he hoped the time would come when a further reduction might be considered possible. The abnormal summer weather had increased the Company's business to the extent of 9 million cubic feet of gas in the half year; being an increase of 5 per cent. upon the corresponding period of 1910. New mains had been added to the Company's system to the extent of 1¼ miles; and some 200 stoves had been fixed in consumers' houses. The profit for the half year showed a slight improvement on 1910; and the Directors recommended the usual statutory dividend.

Mr. G. Geen seconded the motion.

Dr. Garrod Thomas inquired as to how the warm weather increased the consumption of gas.

The Chairman replied that people cooked by gas instead of by coal.

The report was adopted.

The dividend recommended having being declared, and the retiring Directors and Auditor re-elected, a vote of thanks was accorded to the Chairman, Directors, and officers.

The Chairman, in acknowledging the vote, assured the meeting that in the general all-round work of the Company he tried his utmost to ensure success.

The Secretary, in reply, said it was satisfactory that the Company they served was administered by a most efficient Board of Directors. The staff zealously endeavoured to discharge their duties. The Company was a prosperous one, and, though it met with considerable competition, it never went back. There had always been progress, and last year's business was not the least progressive of their many years of prosperity.

The Engineer (Mr. T. Canning) likewise expressed his acknowledgments. He said he had tried his utmost to promote the interests of the Company, and his staff rendered very loyal service. They were engaged on improvements which would bring the undertaking up to date. It was no use attempting to carry on any concern with commercial success unless it was up to date from an engineering point of view. When the works were completed, they would be an advantage not only to the shareholders but to the consumers as well.

TESTING METERS IN MANCHESTER.

Proposal to Put the Electricity Department on the Same Footing as the Gas Department.

At the Quarterly Meeting of the Manchester City Justices on Monday last week, the Gas-Meter Testing Committee presented a report on the suggestion made at the previous meeting that the testing of electricity meters should be under the control of the Gas-Meter Testing Department. The recommendation in the report was to the effect that the testing of electricity meters should be carried out by a Committee independent of the Gas-Testing Committee and the Corporation.

The Chairman of the Gas-Testing Committee (Mr. N. Bradley) said the object of the recommendation was to bring the sellers of electricity under the same conditions as the sellers of gas, so that purchasers of electricity might have the same opportunity of seeing that they had fair measure. He went on to explain that the Sale of Gas Act, 1859, provided that in all boroughs in which the Town Council was the manufacturer and seller of gas the Justices of such boroughs should have the power of carrying into effect provisions for the testing and stamping of gas-meters; and these powers were exercised by the Justices of the City of Manchester through the Justices' Committee. The Manchester City Council were manufacturers and sellers not only of gas but also of electricity; and the Committee felt that what was done in the public interest for the control of gas-meters should also be done in the case of those used for the supply of electricity. In the absence of statutory powers, however, the work of testing these meters could only be transferred to an independent authority by consent of the Corporation.

The Chairman of the Electricity Committee (Mr. G. Howarth) suggested that the Justices should appoint a small Committee to meet a few members of the Electricity Committee, who would be prepared to put the whole facts before them. At present there was no borough or city in the kingdom where there was a separate plant for the testing of electricity-meters; and he reminded the meeting that the Justices had no power to enforce what they proposed.

After some discussion, it was decided to "receive" the report, and to appoint three Justices to meet a similar number of members of the Electricity Committee to consider the question.

DARLINGTON CORPORATION GAS UNDERTAKING.

Annual Accounts.

We have received from the Gas Engineer and Manager of the Darlington Corporation (Mr. Frank P. Tarratt) the accounts of the Gas Department for the twelve months ended the 31st of March, as prepared by the Borough Accountant (Mr. J. W. Armitage). They show that the sale of 349,992,226 cubic feet of gas produced £36,562; that residuals brought in £15,261; and that the total revenue was £54,649. The expenditure on the manufacture of gas was £20,127; on purification, &c., £760; wages came to £4256; repairs cost £4884; distribution, £6369; rates and taxes, £2264; management, £1595; and sundry items brought up the total to £41,469. The balance carried to the profit and loss account was £13,180; and with the amount brought forward, there was produced a total of £18,212. This has been disposed of as follows: Liquidation of loans, £4346; interest on loans, £2527; transferred to district fund in aid of rates, £5500; carried to balance-sheet, £5838. The net profit is £6305; and Mr. Tarratt's working statement shows that this sum is equal to 3s. 2·759d. per ton of coal carbonized, 3·781d. per 1000 cubic feet of gas made, and 4·324d. per 1000 cubic feet sold. The quantity of coal carbonized was 39,043 tons; the make of gas 400,257,000 cubic feet, or 10,251 cubic feet per ton. The residuals produced were: Coke and breeze, 19,678 tons 16 cwt.; tar, 351,260 gallons; ammoniacal liquor, 1,221,400 gallons—yielding respectively 11s. 1d., 21s., and 9s. 1d. per ton. The capital invested in works and plant amounts to £186,253; being at the rate of £4 15s. 5d. per ton of coal carbonized, and 10s. 8d. per 1000 cubic feet of gas sold. The gross profit is 7·076 per cent. upon the total capital employed.

HALIFAX CORPORATION GAS UNDERTAKING.

The Past Year's Working.

The accounts of the gas undertaking of the Halifax Corporation for the past financial year show that the sale of 786,982,800 cubic feet of gas produced a revenue of £82,239; but a sum of £349 was paid to the Sowerby Bridge Urban District Council for 3,180,900 cubic feet supplied to Luddendon—bringing down the total to £81,890. The deduction of discounts further reduced this to £78,964. Meter-rents produced £2352; the sale of residual products, £28,742; and other items made up a total of £111,661. The principal items of expenditure in the past year were: Manufacture and purification of gas, £40,061; maintenance of works, £7862; distribution of gas, £4795; and management, &c., £5153—other items making up a total of £68,384, and leaving a gross profit of £43,277 to go to the net revenue account, compared with £41,369 for the year 1909-10. After meeting interest and sinking fund charges and paying income-tax, there was left a balance of £15,968, compared with £14,222 before. Adding the amount brought forward, £12,977, a total of £28,945 was produced. Out of this was paid to the borough fund account in aid of the rates for the year 1910-11, £7315; to the district fund account, £3657; placed to the reserve fund, £3616; and transferred to the working balance account, £4000; making a total of £18,589, and leaving a balance of £10,356. The amount added to the reserve fund brings it (with £934 interest on investments) up to £31,321.

The accounts relating to the working during the past year show that, under the supervision of the Gas Engineer and Manager (Mr. John Wilkinson), 70,966 tons of coal were employed in the manufacture of 840,618,000 cubic feet of gas, of which 783,941,600 cubic feet were sold and 8,802,300 cubic feet used on the works. The leakage was 47,240,100 cubic feet, or 5·6 per cent. The residuals were 32,335 tons of coke made for sale, 4568 tons of tar, and 839 tons of sulphate of ammonia. The cost of gas at the works was 13·24d. per 1000 cubic feet sold; and the expenses of distribution, &c. (less meter-rents), came to 5·37d.; making a total of 18·61d. The total receipts for gas worked out to 24·17d. per 1000 cubic feet; showing a difference of 5·56d. The balance of profit was 4·89d.; and the accident insurance fund and the cyanide plant account for the rest.

GAS UNDERTAKINGS IN THE POTTERIES.

Reductions in Price.

The report of the Gas Committee of the Stoke-upon-Trent County Borough Council which was submitted at the last meeting of the Council contained recommendations to reduce the price of gas by 2d. per 1000 cubic feet for ordinary purposes in the Burslem and Fenton areas, and by 3d. per 1000 cubic feet for ordinary and power purposes in the Longton area, from the 30th of September next.

Mr. MITCHELL, the Chairman of the Gas Committee, in moving the adoption of the report, said the Committee had hoped that the balance-sheet of the four works would have been in the hands of the members at this meeting; but the delay was due to the Auditors not having completed the accounts. The amended proof had been adopted by the Committee; and upon the profit shown they recommended the reductions in price set forth. The net profits for the year were: Burslem, £4839; Stoke, £1359; Fenton, £1674; Longton, £3573. He thought these figures were satisfactory. It had been decided to let the price of gas in Stoke remain at 2s. 1d., owing to the circumstances of the Stoke undertaking. But with regard to the three other undertakings, the Committee, in consultation with the Managers, had decided to reduce; and, further, all charges for mains and services, meters, cookers, and extension of plant and apparatus, which could reasonably be charged to capital, must be met and paid for out of revenue. The Committee, upon the advice of the Managers, were sanguine that, with the prospect of good markets for residuals and favourable contracts for coal, they could safely recommend the reduction to 1s. 10d. The proposals had been carefully considered, and the total amount of saving to the gas consumers and public lighting authorities would in the three areas be: Burslem, £4002; Fenton, £1130; Longton, £3358—total, £8490. In Longton, the reduction of 3d. per 1000 cubic feet to all ordinary customers would amount to £1729; and the effect of putting the prepayment consumers on the same terms as the ordinary ones (as arranged by the Council) would be a reduction of £1021. If the Hanley prices for public lighting were adopted, the loss would be £608. So that the total estimated reduction in the case of Longton was £3358. In the case of Burslem, the reduction of 2d. on gas sold was £3319; the estimated reduction in the cost of public lighting by the adoption of Hanley prices was £235; and the abolition of meter-rents was £448. So that there was a total reduction in Burslem of £4002. The reductions in Fenton amounted to £1130—£730 for ordinary consumers and £400 for public lighting. The Managers estimated that, allowing for the reductions, the profits next year would be: Burslem, £838; Fenton, £237; Longton, £215. The increases in the quantity of gas sold in the past as compared with the previous year were: Burslem, 25 millions; Stoke, 6¼ millions; Fenton, 8¾ millions; and Longton, upwards of 10¼ millions. In conclusion, he said he thought the time had come when the Council might move in the direction of securing a reduction in the price of gas sold by the British Gas Company in the Hanley and Tunstall areas.

Mr. BROOKHOUSE seconded the motion.

After some discussion, a Committee was appointed to approach the British Company, with the view of obtaining a reduction in price in Hanley and Tunstall.

GAS AND WATER FINANCE AT STOCKPORT.

The annual abstract of accounts for the borough of Stockport, presented at last Wednesday's meeting of the Town Council, showed that the total income for the year in the Gas Department was £122,111, and the expenditure upon revenue account £76,178; leaving a gross profit of £45,933, which had been appropriated as follows: Depreciation, £12,254; interest on capital, £7487; reserve fund, £6842; local rates, 1911-12, £19,350. Out of the reserve fund, £11,016 had been expended during the year; leaving the balance to the credit of this account £5171. The capital expenditure was £11,096; making the total outlay on the gas undertaking £470,055. The deposit account showed £1924 to the credit of gas deposits; £1000 for tar deposits; £184 for fittings deposits; and £414 for accrued bank interest.

The Chairman of the Finance Committee (Mr. Henry Bell) explained that the income from the Gas Department was up by nearly £6300—showing an increase of 5½ per cent. on the previous year. Their expenditure had increased by only 2 per cent. The Gas Committee had put £6842 to the reserve, which was £3800 more than last year; but they had done a good deal of new work, and paid for it out of revenue. This represented £11,000; and the balance now standing in the reserve fund was £5171.

Referring to the Water Department, Mr. Bell said the income for the past financial year was £57,066—an increase of £2075 on the previous twelve months. The expenditure on revenue account was £59,406, or an increase of £1224, of which no less than £706 was due to higher rates. The expenditure which they were committed to in carrying out the important works at Kinder had resulted in an increase of £121,236 on the mortgage debt on the water-works.

IMPROVED PUBLIC LIGHTING IN KENSINGTON.

At the last meeting of the Kensington Borough Council, the Sub-Committee appointed for effecting an improvement in the public lighting of the borough reported that they had inspected a number of "Kensington" pattern lanterns which had been converted for the use of one and two inverted burners respectively. As regards the lamps converted for one burner, they were of opinion that the system would prove in every way satisfactory when correct adjustment of the burners had been made, and the lamps were kept in proper condition; and they had given special directions to the Lighting Engineer on these two points. With regard to the seventy "Kensington" pattern lamps converted for the use of two inverted burners, which had been fixed in Cromwell Road, they considered the results most satisfactory. Under these circumstances, they had decided to give an order to Messrs. D. Anderson and Co. for the conversion of a further 1000 lamps for use with one inverted burner, and for a further 200 "Kensington" pattern lamps for use with two burners. The Sub-Committee also reported with reference to the description of the three-light lamps to be provided in certain streets, that they had inspected lamps of the arc pattern which had been fixed by Messrs. D. Anderson and Co., Messrs. Falk, Stadelmann, and Co., and Messrs. W. Sugg and Co.; and looking to the satisfactory results obtained from these lamps, they were of opinion that similar ones should be provided in those streets in which the Council had decided that three-light lamps should be fixed. The lamps required to complete the lighting of Earl's Court Road are to be obtained from Messrs. Falk, Stadelmann, and Co.; and those for lighting Church Street from Messrs. W. Sugg and Co.

The Whittlesey Gas and Coke Company, Limited (with offices at High Causeway, Whittlesey, near Peterborough), was registered on the 25th ult., with a capital of £2500 in £10 shares.

In connection with the memorable Sidney Street siege, claims to the amount of £2193 were made by parties who had sustained damage; and they were settled for £533. The only claimant to receive payment in full was the Commercial Gas Company, who lost meters, stoves, and gas to the amount of £13 8s. 2d.; and this sum has been paid them.

LIGHTING OF LEAVESDEN ASYLUM.

Inverted Incandescents Replace Flat-Flame Burners.

At a recent meeting of the Metropolitan Asylums Board, the Asylums Committee reported that on the 20th of May the Managers accepted the offer of the Watford Gas Company to supply gas to the Leavesden Asylum, on the terms and conditions set forth in a report by the Engineer-in-Chief. The Clerk of the Board now informed the Committee that he had settled the terms of the agreement between the Managers and the Company, but that there was one point, relative to the candle power of the gas to be supplied, in which the agreement differed from the conditions approved by the Board. In the Engineer-in-Chief's report, 15-candle power was mentioned; whereas the agreement specified that the gas to be supplied should, as regards illuminating power and purity, be subject to the provisions of the Watford Gas Act, 1906, under section 36 of which the prescribed number of candles was to be 13. The Clerk of the Board, however, had been informed that the Gas Company supply 15-candle gas, but that they cannot give any guarantee that the gas shall be of this power when it reaches Leavesden; and he did not see how the Managers could press for more than the Company's Act requires. The Assistant-Engineer saw no objection to the variation being agreed to; and in this the Committee concurred.

The Hospitals Committee reported that the replacement, in a small portion of the Southern (Upper) Hospital, of flat-flame gas-burners (by which the institution was lighted throughout) by inverted incandescent gas-burners having given satisfactory results, they proposed that the whole of the Upper Hospital should be fitted with modern burners, especially as it was estimated that considerable economy would accompany the improvement in the lighting which the suggested change would effect. The Engineer-in-Chief considered there would be a saving of approximately £200 per annum if the number of blocks occupied during the twelve months after the installation were the same as during the year 1910, or about £270 per annum if the hospital were fully occupied. He estimated the expense of the provision of the new burners at approximately £425, including the cost of adjustable pendants (with shades) for lamps in the patients' blocks over the tables at which the nurses sit at night; and he stated that the new burners could be fixed by the hospital staff. There would be 1520 of the existing burners replaced by 1146 others. The Committee recommended: "That the replacement, at an estimated cost of £425, at the Southern (Upper) Hospital, as and when required, of the existing gas-burners by inverted incandescent burners, as advised by the Engineer-in-Chief be sanctioned; and that the Works Committee be instructed to arrange for the execution of the necessary work by the hospital staff, under the supervision of the Assistant-Engineer." The recommendation was adopted.

RAINSTORMS AND TARRED ROADS.

Colonel R. E. Crompton, the Consulting Engineer to the Road Board, sent a letter on this subject to "The Times" the day after the great storm on the 28th ult.; and it appeared in the Engineering Supplement last Wednesday. In it, he made the following remarks.

As one of those responsible for advising the street authorities of London to tar and render dustless their macadam roads, I was naturally much interested to see how far the extensive tarring in Kensington which has been carried out during the present summer has affected the discharge of storm water into the sewers. The storm of yesterday was a true cyclonic electrical disturbance. Its cyclonic nature caused the downpour to be so concentrated that it resembled a waterspout, the centre of which moved rapidly over the area. . . . A large number of gullies were so blocked that the water rose to a high level, basements were flooded, and much damage was done. This was notably the case opposite the Palace Hotel, where the rush from the roadway in Kensington Palace Gardens resembled a Scotch stream in spate.

As soon as the rain slackened, I went round and inspected all the roads which had been tarred on Campden Hill, Phillimore Gardens, and in the Earl's Court and Queen's Gate districts. In every case, even where there were trees, I found the gullies free and clear of grit and no accumulations of water. But in all cases where the roads were left untarred, the gullies had been blocked, and there were accumulations of grit and mud on the road, which were soon churned up and carried afar by the traffic.

The great advantage that tarring has for road authorities in reducing the scour from such storms and the necessary repairs of roads following them was already well known to me; but, as an advocate of the advantages of surface tarring for the macadam roads of London, I was gratified to find that the waterproofing of the streets by tarring greatly assists the scavenging power of the thunderstorms which follow long periods of drought, and at the same time minimizes the erosive and damaging effects on the roadways and the consequent blocking of gullies and flooding of basements.

If His Majesty's Office of Works had seen their way to tar the surface of the road in Kensington Palace Gardens in a similar manner to Queen's Gate, it would have saved the Kensington and Westminster authorities, and the unfortunate owners who had their basements flooded, much discomfort and heavy cost.

Beverley Gas and Water Profits.—The Beverley Corporation Gas Department, for the year ending March 31, shows a gross profit of £5080, and a net profit, after payment of interest, &c., of £3389. There is a gross profit from the Water Department of £1913, and a net profit of £943. These gratifying results, it is pointed out, reflect much credit both on the Gas and Water Committee and the Manager (Mr. F. W. Oldfield). The Committee have decided to give in aid of the rates a sum of £1000 from the gas profits, in addition to the annual contribution of £684 for the drainage loan—making a total of £1684 for the year.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

I fully expected that the gas accounts of the Corporation of Glasgow would have been available for publication this week, as they have been prepared and have been issued to members of the Corporation. There is a very strict rule, however, in the Corporation service, that until a document has been approved by the Town Council it is "private and confidential, and for the use of members only." The gas accounts were on the *agenda* of the meeting on Thursday; and I attended in order to see them adopted. The meeting, unfortunately, was the first which had been held after the holidays; and there was an accumulation of business which threw the item I was interested in down to No. 21 on the list. The Corporation succeeded in disposing of 18 of the items, which fell short of the Gas Committee's report and accounts. As may be expected, so large an undertaking as the Glasgow Corporation Gas Department has many eyes upon it; and information which there is every reason to believe is accurate, though incomplete, has been published in the local Press. It would be a pity to publish what has already appeared, and afterwards to print the full account which we are in the habit of giving in the "JOURNAL." However, it may be stated briefly that the gross revenue for the year amounted to £896,046, and the gross expenditure to £683,482. Depreciation written off capital assets amounted to £66,047, raising the expenditure to £749,529, and leaving a gross balance of £146,517. After payment of annuities, interest, and sinking fund, there remains a sum of £9961, which has been transferred to the credit of the reserve fund.

The Gas Committee recommend that the price of gas for domestic lighting, for quantities of less than 500,000 cubic feet, remain at 2s. per 1000 cubic feet, but that quantities beyond this amount and up to 2 million cubic feet be reduced from 2s. to 1s. 11d.; from 2 to 6 millions to be reduced to 1s. 10d.; from 6 to 10 millions, to 1s. 9d.; and for quantities above 10 million cubic feet, from 1s. 9d. to 1s. 8d. For power and manufacturing purposes, the proposal is to supply gas up to 20,000 cubic feet at the present rate of 2s.; up to 5 million cubic feet, that the rate be reduced from 1s. 8d. to 1s. 6d.; and up to 6 million cubic feet, from 1s. 6d. to 1s. 4d. per 1000 cubic feet. For hotels, clubs, and institutions, other than for lighting purposes, it is recommended that, for quantities above a certain amount, there should be a reduction of 2d. per 1000 cubic feet. It is recommended that the charge for gas supplied through prepayment meters be reduced from 2s. 7d. to 2s. 6d. per 1000 cubic feet; and that for public lamps the charge for gas be reduced from 1s. 8d. to 1s. 6d. per 1000 cubic feet. These proposals, with the Gas Committee's report and the accounts, will all come before the Council at their next meeting. Probably the reason why the Council did not overtake the whole of the business was that attention was engaged with a proposal of the Finance Committee to appropriate out of a surplus of £55,000 which had accrued upon the tramways account, to the amount of £40,000 in relief of the rates, and to the amount of over £11,000 in improving slum areas. Last year the Corporation made their first venture in the direction of aiding the rates from the profits of commercial undertakings, by voting the sum of £15,000 from the tramway profits. There was a fierce and long discussion upon the proposal of the Finance Committee, in the course of which it was pointed out that the Corporation until last year were clean in the matter of aiding the rates, and that then Parliament took away from the Gas Committee the power to make contributions from their revenues towards municipal purposes. This brought out the somewhat curious explanation that the Gas Committee did at one time make such contributions, but ceased making them, and for twenty years did not do so. The further explanations were given that the power to make such contributions was taken away with the consent of the Gas Committee; and that it was done because the power had been so long unused that there was evidently no necessity for it. The Council were informed that the proposed contribution of £40,000 would mean a reduction in the rates of 2d. per pound. The Council decided not to make the appropriation which was recommended, but to set apart the whole of the tramway surplus as a fund to be employed in the improvement of the poorer districts of the city.

This week we in Scotland have been having demonstrations by M. Soyer of his method of cooking food in paper bags. Arranged by the proprietors of the "People's Journal," these demonstrations were given in Edinburgh, Dundee, Aberdeen, Glasgow, and Rothesay, with a return visit to Edinburgh in the beginning of next week, on account of the success of the venture. The cooking was done by means of gas-stoves, which in some (if not all) of the instances were supplied and fitted up free of charge by the local gas authority, who also supplied gas gratis. I attended one of the demonstrations, for the purpose of ascertaining the quantity of gas consumed. When I arrived, fifteen minutes before the demonstration began, the three stoves to be used were already under heat, and so I cannot give the total quantity of gas consumed from start to finish. But from the time I read the meter—fifteen minutes before cooking began till the end of the demonstration, a period of an hour-and-a-half—it indicated that the consumption of gas was almost exactly 100 cubic feet. This was as near as could be a gas consumption to the total amount of 3d. The distinguished *chef*, in the course of the demonstration, cooked as many as 18 dishes, beginning with a joint of 5 lbs. weight, and concluding with baked and stewed fruits. The demonstration fully bears out the claim that the cooking of food in paper bags is economical so far as the consumption of gas is concerned. It may be proper to explain, as accounting for the small consumption of gas, that during the process of cooking the taps are turned down to the extent of one-half.

Sheriff-Substitute Moffatt on Monday gave his decision upon the relevancy of the complaint brought by the Corporation of Falkirk against Bailie Russell, one of their number, of having used for lighting within his premises gas supplied to him at a cheaper rate for power purposes, contrary to section 38 of the Gas-Works Clauses Act, 1847. The Sheriff-Substitute is of opinion that the complaint is relevant; and he has repelled the objections that were stated at a previous diet of the Court. Bailie Russell thereafter pleaded not guilty, and the case was adjourned to Oct. 26 for trial.

The Gas Manager at Kirkcudbright submitted the other day to the

Town Council his estimates of revenue and expenditure for the current year. These showed an income from the sale of gas of £1113, and from residual products of £237—a total of £1350. The expenditure was stated at £1001, which left a balance of £349. From this there was deducted interest on loans, amounting to £136; sinking fund charges, amounting to £165; and other items of expenditure, amounting to £16—which left a net balance of £32. The Manager recommended a reduction in the price of gas for lighting purposes to the extent of 5d. per 1000 cubic feet. This was agreed to. On a proposal that 2s. 6d. per week be added to the wages of the stoker, the Council differed in opinion; and the resolution arrived at was that the stoker receive an increase of 2s. a week, with a bonus of 6d. if he produces on an average 9500 cubic feet of gas per ton of coal carbonized.

The annual meeting of the Banff Gaslight Company was held on Wednesday. The report of the Directors was adopted; and a dividend of 5 per cent. was declared.

The parliamentary inquiry into the application by the Corporation of Falkirk for an extension of the burgh boundaries, which was begun last week, was concluded on Wednesday. During the whole time of the inquiry, the Parliamentary Commissioners were occupied in hearing evidence in support of the application. Among the witnesses examined was Mr. W. Wilson, the Gas Engineer to the Corporation, who considered that the area proposed to be taken in, being mostly supplied already by the burgh, ought to be brought within the boundaries. The Commissioners, without calling for evidence on the part of the objectors (of whom there were about twenty), intimated that they found the preamble of the Bill not proved. In their opinion, the position of the burgh and of the adjoining districts was such that in the near future some extension of the boundaries would probably be necessary; but at the present moment they had no doubt the application was premature. In consequence of the failure of the application, the agreement which was intimated last week as having been come to between the promoters and the Polmont District Gas Company, whereby the Company were to receive £6000 for their interest in the village of Laurieston, falls.

CURRENT SALES OF GAS PRODUCTS.

[For Table of "Tar Products Prices," see p. 378.]

LIVERPOOL, *Aug.* 4.

Sulphate of Ammonia.

With the turn of the month the tone of the market has become quieter, the most pressing requirements having evidently been satisfied. This being the period of smaller production, available supplies are limited, and there has not been any anxiety shown to force sales. Prices have therefore been fully sustained, and the closing quotations are £13 17s. 6d. to £13 18s. 9d. per ton f.o.b. Hull, £13 18s. 9d. to £14 per ton f.o.b. Liverpool, and £14 1s. 3d. to £14 2s. 6d. per ton f.o.b. Leith. Little actual business has transpired in the forward position, but manufacturers maintain a very firm attitude, and it is reported that £14 2s. 6d. per ton has been paid in Scotland for October-March delivery in equal monthly quantities.

Nitrate of Soda.

The market in this article is unchanged, and holders of spot parcels continue to quote 10s. per cwt. for ordinary and 10s. 3d. for refined quality.

LONDON, *Aug.* 4.

Tar Products.

There is little alteration in the markets for tar products; but prices remain very firm. In pitch there is no alteration in price; but high figures are asked in nearly every quarter. Benzols are quiet, but steady. In regard to solvent naphtha, it is difficult to do business in this article at the present moment. Heavy naphthas are firm. Creosote is in good demand. Crude carbolic is very firm, and high prices are reported to have been paid for next year's delivery.

The average values during the week were: Tar, 20s. to 24s., *ex* works. Pitch, London, 39s. to 40s.; east coast, 39s. to 40s.; west coast, Manchester, 38s. to 38s. 6d., Liverpool, 39s. to 40s., Clyde, 39s. to 40s. Benzol, 90 per cent., casks included, London, 9½d. to 10d.; North, 9d. to 9½d.; 50-90 per cent., casks included, London, 8¾d. to 9¼d.; North, 9d. to 9½d. Toluol, casks included, London, 9¾d. to 10d.; North, 9½d. to 9¾d. Crude naphtha, in bulk, London, 4d. to 4¼d., North, 3¾d. to 3⅝d.; solvent naphtha, casks included, London, 11d. to 11¾d., North, 10d. to 10½d.; heavy naphtha, casks included, London, 11½d. to 1s. 0¼d., North, 10d. to 10½d. Creosote, in bulk, London, 2⅜d. to 2½d.; North, 2d. to 2 1/16d. Heavy oils, in bulk, 2¾d. Carbolic acid, 60 per cent., casks included, east coast, 2s. to 2s. 1d.; west coast, 1s. 11d. to 2s. Naphthalene, £4 10s. to £8 10s.; salts, 40s. to 42s. 6d., bags included. Anthracene, "A" quality, 1¼d. per unit, packages included and delivered.

Sulphate of Ammonia.

The inquiry is still very good, and further business has been reported for both this and next year's delivery at improved prices. For the prompt position, the value remains about the same. Actual Beckton is nominally quoted £13 12s. 6d., although it is believed that this make has changed hands at a higher figure. Outside London makes are quoted £13 10s. to £13 12s. 6d., Hull £13 17s. 6d., Liverpool £13 17s. 6d. to £13 18s. 9d., Leith £14, and Middlesbrough £13 17s. 6d. to £13 18s. 9d. For forward delivery, a premium of 2s. 6d. to 3s. 6d. per ton is asked at nearly all ports.

An emphatic objection to the electric light comes from Dublin, where an old man named Brown has been sentenced to two months' imprisonment on a charge of breaking electric fittings in the workhouse. He stated that he objected to the electric light because the inmates of the workhouse could not light their pipes or warm themselves with it.

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COAL TRADE REPORTS.

Northern Coal Trade.

There is a heavier demand for coal in the North, now that the shipments are freed from labour troubles; and there is a desire to accumulate stock. In the steam coal trade, the exports are full, and best Northumbrians are quoted at from about 11s. 6d. per ton f.o.b., second-class steams are from 9s. 6d., and steam smalls are in better request at 5s. to 6s. Production is full; and it is well taken up. In the gas coal trade, there is now an increased demand, both for local use and for shipment; and the prices are very firm, especially for best kinds. Second-class gas coals are about 9s. 6d. per ton f.o.b., best Durhams are from 10s. 6d. to 10s. 7½d., and "Wear specials" from 10s. 10d. to 11s. A sale is reported of a quantity of best Durham for shipment to Genoa this autumn at about 17s. 3d. per ton, delivered at that port—a price a little below that now quoted for occasional cargoes. One or two small contracts are also in the market; but with delivery fairly forward, the tendency is to ask higher prices, because of the expected addition to the cost of production through the legislation that is now in progress. The coke market is brisker. Good gas coke is quoted at from 14s. to 14s. 9d. per ton f.o.b. in the Tyne. The output of gas coke is increasing slowly; but the demand takes it up.

Scotch Coal Trade.

The improvement in the coal market noticed last week has been fully maintained. The demand for shipping is considerably better, and prices are reported to have been advanced 3d. and 6d. per ton. Small stuffs are still in poor demand. The prices quoted are: Ell 9s. to 10s. 3d. per ton f.o.b. Glasgow, splint 9s. 6d. to 10s., and steam 9s. to 9s. 3d. The shipments for the week amounted to 255,130 tons—an increase upon the previous week of 33,238 tons, but a decrease upon the corresponding week of 17,334 tons. For the year to date, the total shipments have been 9,120,607 tons—an increase upon the corresponding period of 84,096 tons.

Malton Gas Company.

The half-yearly meeting of the Malton Gas Company was held last Wednesday—Mr. Hugh W. Pearson (the Chairman) presiding. In moving the adoption of the report and accounts, he said there was a net profit of £1448 on the six months' working; and as the usual dividend of 6 per cent. required £1440, there was a small margin. They had, however, a floating balance of between £1600 and £1700 of past profits which they were entitled to use to equalize dividends; and they also had a reserve of £7122. These two figures made up what was practically a reserve of upwards of £8700, or more than one-third of the paid-up capital. The financial position of the Company, therefore, was undoubtedly a strong one. With the income-tax at 1s. 2d. in the pound, when they paid their dividend tax free it was equal to £12 14s. per cent. per annum. Referring to the Company's assessment appeal early in the year, as reported in the "JOURNAL" at the time, the Chairman remarked that though the Company had completely succeeded, the appeal had cost them £140. But the saving in rates which they would have had to pay, had they submitted to the higher assessment, was at least £80 a year, and with the increased rates at Malton and Norton was probably nearer £100 per annum saved. Consequently, they had already, in the year-and-a-half that had passed since it was sought to raise the assesment, more than recouped themselves the £140. He was sorry he could not say so much for the ratepayers, as the cost to them by what he could only regard as the obstinacy and wrong-headedness of the Assessment Committee, was practically £1000. It was a much-needed lesson to them, as he found from experience that it was next to impossible for any ratepayers—especially an industrial concern like the Company—to get fairly good treatment. The report was adopted, and a dividend of 6 per cent. for the half year, free of income-tax, declared.

Felixstowe Water Purchase Question.—The Felixstowe and Walton Urban District Council have passed a resolution in favour of the purchase of the undertaking of the local Water Company; and they have resolved that their Parliamentary Agents shall take all the necessary steps in connection with the promotion of a Bill for the purpose.

Reduced Price at Runcorn.—At the half-yearly general meeting of the Runcorn Gas Company, the Chairman (Mr. Frederick Rigby) congratulated the shareholders on the successful report submitted, and announced a reduction in the price of gas of 2d. per 1000 cubic feet, from July, and a further reduction of 2s. 6d. per lamp on the lamps of the town.

Gas v. Electricity at Dawlish.—A test of the use of gas and electricity for public lighting is to be carried out at Dawlish. The District Council decided last Wednesday to accept an offer by the Electric Light Company to erect and maintain six lamps in the Strand for twelve months; the Council to pay 3d. per unit for the current. The Gas Company will at the same time put up six lamps of the same power in another street, and will maintain them for the same period, charging for the gas 2s. per 1000 cubic feet.

Voelker Lighting Corporation, Limited.—The annual meeting of the shareholders was held at the works at Wandsworth last Friday, when the report and balance-sheet, which were referred to in the "JOURNAL" last week (p. 313), were duly adopted. This action by the shareholders was not surprising, as the report all round was of so favourable a character. A vote of thanks was unanimously passed to the Directors and the heads of departments, for the satisfactory manner in which the business continues to be conducted. It is generally admitted that competition in the gas-mantle industry is of the keenest; and it may therefore be assumed that the good results obtained by the Voelker Corporation are mainly due to excellence of manufacture, which, it is pleasing to note, is wholly British.

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Lighting the South Pontoon of Woolwich Ferry.

At the meeting of the London County Council last Tuesday, the Highways Committee reported having been in negotiation with the South Metropolitan Gas Company with regard to the improvement of the lighting on the south pontoon of Woolwich Ferry. The Company stated that they were prepared to instal new high-pressure incandescent gas-lamps in substitution for all the existing lamps on the ferry for the sum of £77 4s. 8d., and allow £6 for the old lamps; also to alter the hanging of the lamps on the bridge approaches with a view to making them as effective as the lamps similarly placed on the north pontoon. The Committee stated that the total expenditure involved by the acceptance of the Company's offer amounted to £107 4s. 8d. (less £6 for the old lamps); but as the alterations would have the effect of considerably improving the lighting, as well as of materially reducing the consumption of gas and the annual maintenance charge in respect of the lamps, they recommended that the Company's offer should be accepted. This was agreed to.

Grantham Gas Company.

At the ordinary half-yearly general meeting of this Company held last week, the Directors reported that they were again able to present a very satisfactory balance-sheet; showing a sum of £3834 to the credit of the profit and loss account. Out of this, they recommended that £2000 should be applied in payment of the maximum dividend of 5 per cent. per annum on the consolidated stock, and that the balance should be carried forward. The Directors thought the time had arrived when a further reduction might be made in the price of gas; and they therefore proposed that to all consumers it should be reduced from Sept. 30 next by 2d. per 1000 cubic feet—viz., from 2s. 11d. to 2s. 9d. They also reported that the co-partnership scheme had been working smoothly and successfully, and that, in consequence of the reduction in the price of gas in 1909, the bonus paid was at the increased rate of 5 per cent. This had been much appreciated by the employees, who would next year be entitled to a still further increased benefit by reason of the reduction in price of gas, as now proposed. The Chairman (Mr. J. G. Thompson), in moving the adoption of the report, said the accounts were the most satisfactory ever presented in the history of the Company. For this they were indebted to the Manager (Mr. R. G. Shadbolt), the employees and the consumers. The employees were partners in the concern. Three years ago they had a bonus of 3½ per cent.; last year, through the reduction in the price of gas, it was increased to 5 per cent.; and now, on account of the further reduction, it would again go up. The report was adopted.

Fire at the Acton Compressing Station.—A slight fire occurred last Friday week at the Acton compressing station of the Brentford Gas Company, due to the failure of a valve on the high-pressure main to shut tight, causing an escape during a small repair to the compressor. There was no explosion; but the engine man was burnt about the face and arms. The Acton compressor station is one of the largest in the kingdom; and supplies gas to 3 miles of high-pressure mains. There are 604 lamps fed from this plant; and the supply to them was not interfered with. The damage done was at once repaired.

Gas-Cooker Tenders at Warrington.—A discussion on tenders followed upon the recommendation of the Warrington Corporation Gas Committee, at the meeting of the Town Council last Wednesday, respecting the acceptance of a tender from an outside Company for 100 gas-cookers. Alderman Pierpoint, the Chairman of the Committee, explained that there were two important local firms of gas-stove makers, and it was with great regret that the Committee had had to pass them by, and give the order to others; but the difference in price was 10 per cent. Mr. Jenkins moved an amendment to refer the matter back for further consideration, on the ground that the local concerns mentioned paid a large amount in rates, and ought to have a preference. There was a good deal of local feeling that this tender should have been allowed to go out of the town. After some discussion, however, the amendment was withdrawn, and the Committee's action approved.

Question as to Depth of Mains at Bakewell.—At the Town Hall, Bakewell, on Monday last week, two of the Justices of the Peace (Messrs. G. J. Marples and B. Morton) sat as Arbitrators to decide a case between the Bakewell Urban District Council and the Derbyshire County Council. The District Council, for whom the Clerk (Mr. V. R. Cockerton) appeared, are laying mains from the gas-works to the villages of Ashford and Longstone. They are being laid at a depth of from 2 ft. 1 in. to 2 ft. 4 in.; and the County Council (for whom Mr. G. G. Bailey, one of the Council's officers, appeared) contended that on the main roads the pipes should be laid at a depth of 3 feet. In the absence of an undertaking on the part of the District Council to enter into an agreement which would protect the County Council in case of damage to the pipes through heavy traffic, the District Council declining to give such an undertaking, the Court found that the mains were being laid at an ample depth.

Fatal Accident at the Halifax Gas-Works.—An inquest has been held at Halifax relative to the death of John Cardwell, who for over thirty years had been employed at the Corporation gas-works. It was stated that Cardwell had charge of the coke-conveyor; and that last Thursday week he was on the night shift. Shortly after 12 o'clock, he was found lying insensible on the floor, having apparently fallen from the gangway alongside the conveyor, a distance of 9 feet. No one saw him fall, as the rest of the men were in the cabin. Three ribs were fractured, and had perforated the lungs; and the right side of the head was severely lacerated, the ear being torn off. He died at the infirmary on the following Monday. A verdict of "Accidental death" was returned; and the Jury expressed the opinion that a rail should be fixed at the side of the gangway. Mr. J. Wilkinson, the Manager of the gas-works, said the Corporation would provide a rail as suggested. On behalf of the Corporation, Mr. Morton expressed regret at the accident, and sympathy with the widow and family. He mentioned that this was the first fatal accident at the gas-works for forty years.

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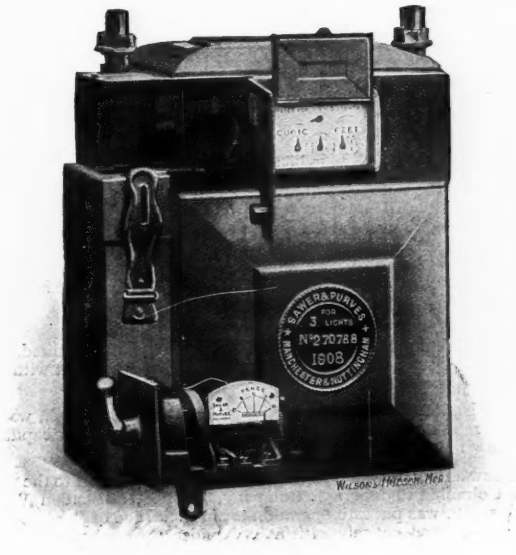

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Shortage of Water in Paris.—Writing last Tuesday, the Paris Correspondent of the "Daily Mail" said: "The shortage of drinking water in Paris gives rise to anxiety. A conference took place to-day between the Prefect of the Seine (M. Delanney), the Seine Engineers, and Dr. Roux, Director of the Pasteur Institute, at which plans were discussed for making the Seine water drinkable. Experiments will be made immediately. Of the six large reservoirs which supply Paris with water, one at Montsouris is now dry, while another is only a quarter full. The St. Cloud reservoir contains only 75,000 cubic metres as compared with 300,000 cubic metres under normal conditions. The authorities still hope to save the situation by hastening the completion of the new reservoir at St. Maur, which is capable of holding 300,000 cubic metres of sterilized water. Meanwhile, the pressure is exceedingly low, and people occupying lofty flats have to fetch their water in jugs from the street mains." It is proposed to utilize the water of the River Marne, after filtration and chemical treatment.

The Recent Kirkcaldy Gas Arbitration.—The following appeared in the "Glasgow Herald" last Tuesday: "The claims of the Kirkcaldy Gaslight Company against the Corporation for their skilled witnesses' fees in connection with the recent arbitration proceedings were before the Auditor of the Court of Session on Friday, and the finding, which has just been received in Kirkcaldy, shows that the Gas Company claimed fees for seven skilled witnesses, the sum claimed being £3446 6s. 7d., and the Court struck off £2532 13s. 4d.; leaving a sum of £913 15. 3d. to be paid by the Corporation. The details were as follows: Mr. Cash claimed £548 3s. 6d., allowed £386 8s. 6d.; Mr. A. M'Pherson claimed £686 4s. 4d., allowed £63; Mr. H. Woodall claimed £639 12s. 9d., allowed £283 9s. 9d.; Mr. E. H. Stevenson claimed £699 0s. 7d., allowed £31 10s.; Mr. H. O'Connor claimed £203 8s. 8d., allowed £5 5s.; Mr. Marwick claimed £531 1s. 9d., allowed £52 10s.; Mr. Morland claimed £138 17s., allowed £91 12s."

Southampton Water Supply.—At the last meeting of the Southampton Town Council, a motion by Mr. Kimber, submitted at the previous meeting, that the Council should immediately consult an independent geological expert to advise whether or not an additional supply of pure water could be obtained at Otterbourne or its immediate vicinity, and that the Parliamentary and Water (Joint) Committee should select and confer with the expert, was again under consideration. The mover urged that the present was a very appropriate time to adopt the course proposed, as there had been a period of almost unprecedented drought. Alderman Dunsford moved an amendment to the effect that power be given to the Committee to consult "all necessary experts," though he thought that their present one (Mr. William Whitaker) was second to none. The Mayor (Alderman E. Bance) appealed to the members to adopt the amendment. He said though there was still a full and good supply of water, they must not jump to the conclusion that they had everything they wanted. No one was more thankful than he that they had a good supply; but they must look forward to future requirements. After discussion of a rather heated nature, the amendment was carried by a large majority.

The Richmond Gas Stove and Meter Company, Limited, have secured a contract to supply the Corporation of Stockport with 1000 grillers.

The firm of Bale and Church, of 5, Crooked Lane, E.C., was, on July 31, registered as a limited liability company, with a capital of £1000 in £1 shares.

A new automatic water supply, from the River Wandle to the works of the Columbia Phonograph Company, Limited, at Bendon Valley, Wandsworth, was put into operation towards the end of June, and has, we learn, proved entirely satisfactory under the particularly trying atmospheric conditions which have since existed. After filtration, the water runs by gravitation to a well in the works, and is then lifted by a direct-acting pump, circulated round the casings of a large number of hot presses, and delivered into a cooling-tank, whence it is returned to the river without loss. The supply is automatically controlled by the requirements. The new plant has effected an immediate economy in the working expenses equivalent to a saving of from £400 to £500 a year. The works were designed by Messrs. Henry Adams and Son, and were carried out by direct labour under their supervision.

Messrs. W. Underwood and Co., of Dukinfield, have secured a £70,000 contract for the construction of extensive water-works at Mountain Ash, South Wales.

Municipal employees of Manchester and Salford, including those in the gas and water departments, have adopted a resolution that after the 31st inst. they will refuse to work with non-Unionists. It is stated that 90 per cent. of the workers are members of the Municipal Employees' Association.

The Worthing Town Council are seeking power to borrow £4950 for extending the electricity undertaking. Comparisons have, however, been made which show that, while the electricity is costing £3874, an equal light could be obtained by gas for £1547 which is equal to a saving to the ratepayers of 3d. in the pound.

Though the Portsmouth Corporation are conducting an electricity undertaking at the public expense, the continued faith in the Portsea Island Gas Company is evidenced by the fact that last Wednesday the Company's £50 shares realized the following prices: "A" shares (13 per cent.), £142 to £144; "B" shares (12 per cent.), £135; "C" shares (10 per cent.), £126.

An excellent exhibition of appliances for gas lighting, heating, and cooking, arranged by the Directors of the Yorktown and Blackwater Gas Company, has just been held at the St. George's Hall, Camberley; and in connection therewith Miss Illie Miles gave each afternoon and evening interesting lectures on the advantages of gas compared with ordinary fires for culinary purposes. Specially attractive were the demonstrations with the new paper-bag cooker, for which Miss Miles said gas-stoves were particularly suitable. There were crowded attendances at all the lectures. Messrs. Arden Hill and Co. showed all their latest appliances for gas heating, lighting, and cooking; and Miss Miles pointed out that the terms on which they could be obtained were now such as should induce all householders to use gas-stoves.

APPLICATIONS FOR LETTERS PATENT.

16,880.—Wilson, A. B., "Compressing apparatus." July 24.
16,887.—Horstmann, S. A., A., & G. O. H., Edgar, W. T., and Horstmann, E. H., "Pressure-controlled distance lighting and extinguishing apparatus for gas." July 24.
16,899.—Roberts, E., "Liquid for the treatment of coal, coke, or any other fuel." July 24.
16,916.—Potterton, T., "Gas-ovens." July 24.
16,920.—Ham, C. G., "Reducing-valves." July 24.
16,931.—Burke, C. R., "Producing light hydrocarbons." July 24.
16,939.—Reiss, C., "Incandescent gas-lamps." July 24.
17,032.—Davis, H. N., and Twigg, W. R., "Gas-fires." July 25.
17,044.—Shotter, G. F., "Measurement of the level and flow of liquids." July 25.
17,055.—Körner, E., "Controlling the lighting of gas from a distance." July 25.
17,096.—Seyd, F. O., "Gas advertising apparatus." July 26.
17,157.—Girod, F., and Graflich von Landsberg-Velen & Gemen'sche Chemische Fabrik, Berg-und Huttenwerke G. m. b. H., "Manufacturing light coloured sulphuric acid, free from arsenic and iron, by the lead chamber method." July 26.
17,158.—Girod, F., and Graflich von Landsberg-Velen & Gemen'sche Chemische Fabrik, Berg-und Huttenwerke G. m. b. H., "Concentrating sulphuric acid." July 26.
17,214.—Anderson, D., "Controlling cocks and switches." July 27.
17,220.—Stephenson, J., "Generation of water gas." July 27.
17,257.—Wagner, F., "Lighting and extinguishing gas-lamps by variations in pressure." July 28.
17,297.—Spiridonoff, B. de, "Cocks or valves." July 28.
17,298.—Anderson, D., "Incandescent gas-lamps." July 28.
17,318.—Fletcher, Russell, and Co., Ltd., and Fletcher, T. W., "Blow-pipes." July 29.
17,319.—Fletcher, Russell, and Co., Ltd., and Fletcher, T. W., "Gas-stoves." July 29.
17,320.—Fletcher, Russell, and Co., Ltd., and Fletcher, T. W., "Blow-pipes." July 29.
17,368.—Koller, K., "Gas-producers." July 29.

TAR PRODUCTS PRICES.

Representative manufacturers give the following as fair current values for the week ending Aug. 5. Prices are net, and they include the usual packages and delivery f.o.b., f.a.s., or f.o.r., as customary.

Article.	Basis.	London.	North-East Coast.	East Coast, Yorks.	West Coast.		Glasgow.
					Liverpool.	Manchester.	
Tar, crude	per ton	28/– 30/–	20/– 25/–	20/6 24/6	21/– 22/6	20/3 22/9	—
Pitch	"	40/–	39/–	40/–	40/–	39/–	—
Benzol, 90%	per gallon	—	–/9½	–/9	–/9¼	–/9¼	—
Benzol, 50-90%	"	—	–/10	–/9½	–/8¼	–/8½	—
Toluol, 90%	"	—	–/10	–/10	–/10	–/10	—
Crude naphtha, 30%	"	—	–/4¼	–/4	–/3½	–/3½	—
Light oil, 50%	"	—	–/3½	–/3⅜ –/4	–/3⅛ –/3¼	–/3¼	—
Solvent naphtha, 90-160	"	—	–/10	–/10	–/10	–/10	—
Heavy naphtha, 90-190	"	—	–/11	–/11½	–/11¼	–/11¼	—
Creosote in bulk	"	–/2¾	–/2	–/2	–/2⅛	–/2⅛	—
Heavy oils	"	–/3	–/2½ –/2⅝	–/2¼	–/2¾	–/2¾	—
Carbolic acid, 60's	"	—	2/–	2/1	1/11	1/11	—
Naphthalene, crude drained salts	per ton	—	43/9	41/3	47/6	47/6 50/–	—
" pressed	"	—	60/–	63/–	60/–	60/– 72/6	—
" whizzed	"	—	—	—	60/– 72/6	60/– 75/–	—
Anthracene	per unit	–/2	–/1½	–/1½	–/1¼	–/1¼	—